# Continued Application of U-Pb Geochronology Methods to the Absolute Age Determination of Secondary Calcite: 2014-2016

**NWMO-TR-2016-07** **July 2016**

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# ABSTRACT

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**Author(s):** Donald W. Davis
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**Abstract**
Previous results reported by Davis (2013) determined that uranium-lead geochronology techniques, including laser ablation inductively-coupled mass spectrometry and thermal ionization mass spectrometry, were suitable for assessing the timing of emplacement of secondary vein and vug calcite in deep Ordovician and shallow Devonian-aged carbonate sedimentary rocks of the Michigan Basin. The current report presents results on the absolute age determination of 15 additional secondary calcite samples. These samples were collected from drill core of Devonian and Silurian age from the Paleozoic carbonate sedimentary rocks beneath the Bruce nuclear site, near Tiverton, Ontario (Intera, 2011; NWMO, 2011). The current report also includes revised previous results from Davis (2013) that together summarize the current understanding of the geochronology of secondary calcite mineral emplacement within the Paleozoic bedrock on the eastern flank of the Michigan Basin beneath the Bruce nuclear site.

The new data presented herein reveal a complex history of fluid mobility, and vein and vug emplacement ranging from late during the Paleozoic Era to the Pleistocene. Samples that extend down to approximately 180 metres vertical depth below ground surface (Upper Silurian Bass Islands Formation) show evidence for multiple secondary calcite ages ranging between ca. 100 and 0 Ma. Secondary calcite from the deeper Silurian Salina A1-Unit yields an age of 318 ± 10 Ma, as well as, scattered younger ages.

Some of the LA-ICPMS data acquisition methods employed by Davis (2013) were identified for additional refinement, including the selection of the most suitable analytical standard and the selection of optimal laser beam wavelength for data collection. In addition, new software has been employed for processing the LA-ICPMS data. The outcome is a statistically more robust methodology for the application of U-Pb geochronology techniques to secondary calcite.

## TABLE OF CONTENTS


**Page**

**ABSTRACT ...................................................................................................................iii**

**1. INTRODUCTION ..........................................................................................1**

**1.1 SAMPLES ..........................................................................................1**

**2. METHODS ..........................................................................................4**

**2.1 BIAS CORRECTIONS FOR NIST610 AND NIST612 GLASS STANDARDS ANALYSIS USING THE 213 nm AND 193 nm LASERS ..............................5**

2.1.1 213 nm Laser ..........................................................................................5

2.1.2 193 nm Laser ..........................................................................................7

**2.2 LA-ICPMS DATA REDUCTION ..........................................................................................8**

**2.3 ID-TIMS METHOD ..........................................................................................9**

**3. LA-ICPMS RESULTS ..........................................................................................10**

**3.1 RECALCULATION OF PREVIOUS LA-ICPMS DATA ................................10**

**3.2 NEW LA-ICPMS DATA FROM DGR CORE ................................................13**

3.2.1 DGR-3-037.37 Devonian Lucas Formation ................................................13

3.2.2 DGR-4-073.73 Devonian Amherstburg Formation.......................................14

3.2.3 DGR-3-096.59 Devonian Bois Blanc Formation ..........................................14

3.2.4 DGR-1-113.55 Devonian Bois Blanc Formation ..........................................14

3.2.5 DGR-3-113.17 Devonian Bois Blanc Formation ..........................................17

3.2.6 DGR-1-120.18 Devonian Bois Blanc Formation ..........................................18

3.2.7 DGR-3-133.17 Devonian Bois Blanc Formation ..........................................19

3.2.8 DGR-3-162.07 Silurian Bass Islands Formation..........................................19

3.2.9 DGR-3-180.06 Silurian Bass Islands Formation..........................................19

3.2.10 DGR-3-186.43 Silurian Bass Islands Formation..........................................20

3.2.11 DGR-4-344.18 Silurian Salina A-1 Carbonate .............................................21

**4. ID-TIMS RESULTS ..........................................................................................23**

**5. DISCUSSION ..........................................................................................25**

**6. SUMMARY ..........................................................................................27**

**REFERENCES ..........................................................................................28**

**APPENDIX A1 SUMMARY OF RECALCULATED LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE ..........................................................................33**

**APPENDIX A2 SUMMARY OF NEW LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE..........................................................................................49**

**APPENDIX A3 SUMMARY OF ID-TIMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE ...61**

## LIST OF TABLES

**Page**

Table 1: List of Samples Analysed Using U-Pb Geochronology Methods, Including Previous (Davis, 2013) and Recent (2014-2016) Work....................................................................2

## LIST OF FIGURES

**Page**

Figure 1: Secondary Calcite Surface and Core Sample Stratigraphic Locations for the 2013 (Davis, 2013) and 2014-2015 Phases of Work and Summary of Age Results from all Successful U-Pb Analyses.  Plot also Includes Samples that Failed to Yield Useful Age Data ........................................................................................................................3
Figure 2: A) Whole Calcite Grains on Parafilm Mounted for LA-ICPMS Analysis. B) Polished Calcite Grains Mounted for LA-ICPMS Analysis. C) Vug Rimmed with Calcite Crystals in Dolostone Sample DGR-1-034 Mounted for LA-ICPMS Analysis ........................................4
Figure 3: A) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST610 Standard Ablated with a 213 nm Laser Beam.  B) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST612 Standard Ablated with a 213 nm Laser Beam .....................................6
Figure 4: A) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST610 Standard Ablated with a 193 nm Laser Beam.  B) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST612 Standard Ablated with a 193 nm Laser Beam .....................................7
Figure 5: A to D) U-Pb Concordia Data from Surface Vein Calcites Recalculated with New Software and Corrected for Calcite-Standard Glass Bias..................................................11
Figure 6: U-Pb Concordia Data from Shallow Vein Calcites Recalculated with New Software and Corrected for Calcite-Standard Glass Bias. Lines are Approximate Visual Fits to Data Subsets...........................................................................................................................12
Figure 7: U-Pb Concordia Data from Ordovician Vein Calcite Recalculated with New Software and Corrected for Calcite-Standard Glass Bias................................................................12
Figure 8: U-Pb Concordia Data from Sample DGR-3-037.37 Vein Calcites ..............................13
Figure 9: U-Pb Concordia Data from Sample DGR-4-073.73 Vein Calcites ..............................14
Figure 10: A) Exposed Face of Sub-Vertical Calcite-Coated Fracture in DGR-1-113.55 Core Sample. B) U-Pb Concordia Data from Sample DGR-1-113.55 Vein Calcites with Approximate Contamination Lines. Most of the Data in the Younger (<50 Ma) Arrays are From Crystal Faces.........................................................................................................15
Figure 11: A) BSE Image of a Polished Vein Calcite Grain from Sample DGR-1-113.55. Data for this Grain is Shown Below. B) U-Pb Concordia Data on a Single Polished Vein Calcite Grain from Sample DGR-1-113.55..........................................................................16
Figure 12: A) Exposed Face of Sub-Vertical Calcite-Coated Fracture in DGR-3-113.17 Core Sample. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-3-113.17. All but Four of the Younger Data Shown in the Inset were from Crystal Faces...................................17
Figure 13: U-Pb Concordia Data on Vein Calcite from Sample DGR-1-120.18 .........................18
Figure 14: U-Pb Concordia Data on Vein Calcite from Sample DGR-3-133.17. Contamination Lines are Approximate. ..........................................................................................19
Figure 15: A) Calcite-Filled Opening in Core Sample DGR-3-180.06. B) U-Pb Concordia Data on Vein Calcite from Core Sample DGR-3-180.06 ..........................................................20
Figure 16: A) Calcite-Filled Vug from DGR-3-186.43 Near Base of the Bass Islands Formation. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-3-186.43..............................21

Figure 17: A) Predominantly Horizontal mm-Scale Calcite Veins with a Few Vertical Veins from DGR-4-344.18 in the Silurian Salina A-1 Carbonate Unit. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-4-344.18 ........................................................................22
Figure 18: A) U-Pb Concordia Data Measured by ID-TIMS on Vein Calcite from Surface and Near-Surface Samples Collected from Devonian and Silurian-aged Bedrock. B) U-Pb Concordia Data Measured by ID-TIMS on Vein Calcite from Devonian and Silurian-aged Bedrock ........................................................................24
Figure 19: A to C) Probability Density Distributions for LA-ICPMS Model Ages from Calcite Samples Down to Approximately 180 Metres Vertically Below Ground Surface ................26

# 1. INTRODUCTION

Previous results reported by Davis (2013) determined that existing uranium-lead (U-Pb) geochronology techniques, including laser ablation inductively-coupled mass spectrometry (LA-ICPMS) and thermal ionization mass spectrometry (ID-TIMS), were suitable for assessing the timing of emplacement of secondary vein and vug calcite in Ordovician and Devonian-aged carbonate sedimentary rocks of the Michigan Basin. The current report presents additional results from continued application of U-Pb geochronology to the absolute age determination of 15 secondary calcite samples. These samples were collected from drill core of Devonian and Silurian age from the Paleozoic carbonate sedimentary rocks beneath the Bruce nuclear site, near Tiverton, Ontario (Intera, 2011; NWMO, 2011). The current report also includes revised previous results from Davis (2013) that together summarize the current understanding of the geochronology of secondary calcite mineral emplacement within the Paleozoic bedrock beneath the Bruce nuclear site.

Some of the LA-ICPMS data acquisition methods employed by Davis (2013) were identified for additional refinement, including the selection of the most suitable analytical standard and the selection of optimal laser beam wavelength for data collection. In addition, new software has been employed for processing the LA-ICPMS data. These refinements are described below. The outcome is a statistically more robust methodology for the application of U-Pb geochronology techniques to secondary calcite.

## 1.1 SAMPLES

New results, based on the refined LA-ICPMS methodology and ID-TIMS analyses, are presented for 15 core samples collected at shallow to intermediate levels beneath the Bruce nuclear site (Table 1 and Figure 1). These carbonate vein samples span the lower Devonian to middle Silurian interval of the Paleozoic succession. Table 1 and Figure 1 also include the list and location, respectively, of samples previously analysed and reported in Davis (2013). Note that the first number of the core sample name (e.g., 3-779.15) in Table 1 and Figure 1 reference the borehole number drilled at the Bruce nuclear site, and the second value indicates the depth of the mid-point of the sample measured along the borehole axis. In addition, Figure 1 provides a summary of ages from both the previous data and new data presented below. Appendix A1 and Appendix A2 present summaries of all LA-ICPMS isotopic analyses undertaken on vein calcite. Appendix A3 presents a summary of all ID-TIMS isotopic analyses undertaken on vein calcite.

In both the previous work and recent work discussed herein some of the analysed samples failed to yield useable age information, primarily due to extremely low U and/or high common Pb concentrations. The sample locations for these failed U-Pb analyses are also included on Figure 1.

**Table 1: List of Samples Analysed Using U-Pb Geochronology Methods, Including Previous (Davis, 2013) and Recent (2014-2016) Work**

| | Sample # | Formation (Period) | LA-ICPMS | ID-TIMS |
|---|---|---|---|---|
| **Davis Analyses 2013** | DD12-11NE | Lucas (Devonian) | X | X |
| | DD12-12SE | Lucas (Devonian) | X | X |
| | DD12-12FV | Lucas (Devonian) | X | X |
| | DD12-13N | Lucas (Devonian) | X | X |
| | DGR-3-037.37 | Lucas (Devonian) | X | |
| | DGR-3-034.61 | Lucas (Devonian) | X | X |
| | DGR-3-034.90 | Lucas (Devonian) | X | |
| | DGR-5-704.44 | Collingwood (Ordovician) | X | |
| | DGR-5-706.80 | Collingwood (Ordovician) | X | X |
| | DGR-6-756.48 | Cobourg (Ordovician) | | X |
| | DGR-6-782.95 | Sherman Fall (Ordovician) | X | |
| | DGR-3-779.15 | Coboconk (Ordovician) | X | |
| | DGR-6-883.75 | Coboconk (Ordovician) | X | |
| | DGR-6-886.91 | Coboconk (Ordovician) | X | |
| | DGR-6-892.99 | Coboconk (Ordovician) | X | |
| | DGR-4-818.36 | Coboconk (Ordovician) | X | |
| | DGR-4-848.29 | Cambrian | X | |
| **Davis Analyses 2014-2016** | DGR-4-073.73 | Amherstburg (Devonian) | X | |
| | DGR-3-096.59 | Bois Blanc (Devonian) | X | |
| | DGR-1-113.17 | Bois Blanc (Devonian) | X | X |
| | DGR-3-113.55 | Bois Blanc (Devonian) | X | |
| | DGR-1-120.18 | Bois Blanc (Devonian) | X | |
| | DGR-3-133.17 | Bois Blanc (Devonian) | X | |
| | DGR-3-162.07 | Bass Islands (Silurian) | X | |
| | DGR-3-180.06 | Bass Islands (Silurian) | X | X |
| | DGR-3-186.43 | Bass Islands (Silurian) | X | X |
| | DGR-1-277.72 | Salina B-Unit (Silurian) | X | |
| | DGR-4-344.18 | Salina A-Unit (Silurian) | X | X |
| | DGR-3-391.17 | Guelph (Silurian) | X | |
| | DGR-4-377.35 | Guelph (Silurian) | X | |
| | DGR-5-412.95 | Guelph (Silurian) | X | |
| | DGR-2-844.31 | Cambrian | X | |

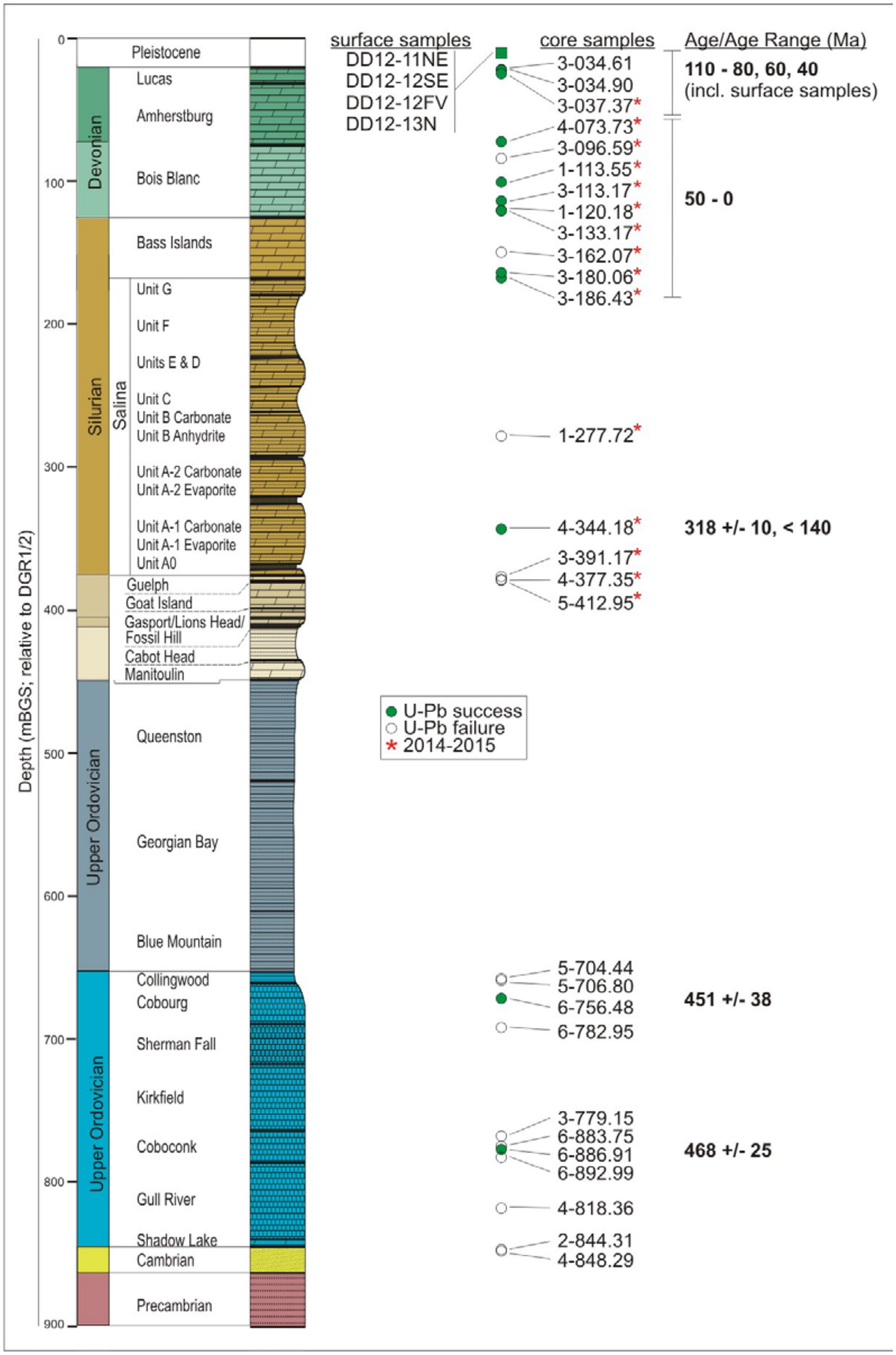
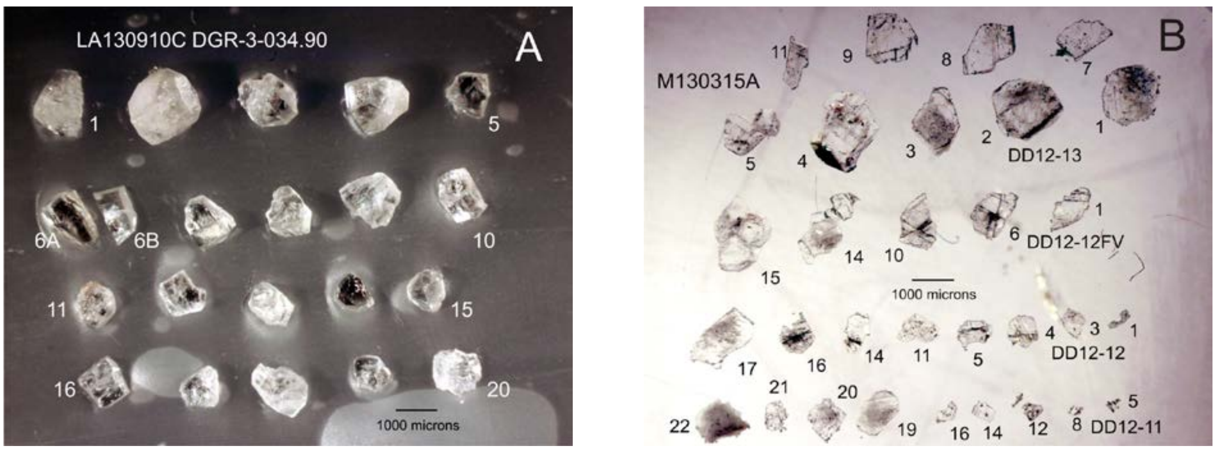



**Figure 1: Secondary Calcite Surface and Core Sample Stratigraphic Locations for the 2013 (Davis, 2013) and 2014-2015 Phases of Work and Summary of Age Results from all Successful U-Pb Analyses. Plot also Includes Samples that Failed to Yield Useful Age Data**

## 2. METHODS

The methods employed for the U and Pb isotope analysis of secondary calcite followed the general approach of Davis (2013). Calcite collected from veins in core samples was analyzed using LA-ICPMS either as whole grains (Figure 2A), polished grains (Figure 2B) or *in situ* in the case of vugs (Figure 2C). For ID-TIMS analysis, which is more accurate than LA-ICPMS but also much more labour intensive, the first step identified grains with relatively high U and low common Pb contents using LA-ICPMS. These grains were subsequently analyzed by ID-TIMS using single or multiple dissolution steps. Davis (2013) showed that general consistency in age results between the two methods provided a measure of confidence that the LA-ICPMS results are broadly accurate.



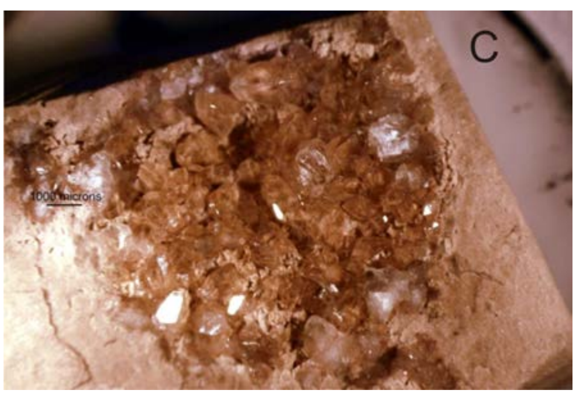




**Figure 2: A) Whole Calcite Grains on Parafilm Mounted for LA-ICPMS Analysis. B) Polished Calcite Grains Mounted for LA-ICPMS Analysis. C) Vug Rimmed with Calcite Crystals in Dolostone Sample DGR-1-034 Mounted for LA-ICPMS Analysis**

Some refinements to the LA-ICPMS methodology for U-Pb analysis of calcite were made since Davis (2013). This included a determination of the most appropriate external calibration standard to use; either of National Institute of Standards and Technology (NIST) standard glass samples, NIST-610 or NIST-612. It also included determination of optimal laser wavelength, either 213 nm or 193 nm, using two different instrument systems: a New Wave UP-213 laser ablation system with a 213 nm beam coupled to a VG Series 2 Plasmaquad ICPMS with enhanced pumping (S-option) for increased sensitivity, or a New Wave UP-193 laser ablation system with a 193 nm beam coupled to an Agilent 7900 ICPMS. The results of this analysis are presented below in Section 2.1. Section 2.2 describes the rationale for implementing a new data reduction method to the LA-ICPMS results.

The analytical approach was the same regardless of the laser employed. Secondary calcite samples were ablated and analyzed using two instrument systems. The laser beam diameter for calcite was in the range 100-150 microns, 10-20 Hz with a fluence of about 5 $J/cm^2$. Frequency and beam size were reduced for the more concentrated NIST610 glass standard and appropriate correction factors applied to calculate U concentrations of samples. Measurements were carried out on $^{206}Pb$, $^{207}Pb$ and $^{238}U$, as well as $^{232}Th$ to test for detrital material. Spots were pre-ablated by rastering the beam over an area larger than the beam diameter to clean the surface. Following a 10 sec period of baseline accumulation the laser sampling beam was turned on and data were collected for 25 seconds followed by a washout period. The same methods were also applied to the new analyses presented in Section 3.2 below.

## 2.1 BIAS CORRECTIONS FOR NIST610 AND NIST612 GLASS STANDARDS ANALYSIS USING THE 213 nm AND 193 nm LASERS

NIST610 and NIST612 glasses were compared for their applicability as external calibration standards for U-Pb analysis of calcite. While it would be ideal to use a calcite standard, there is currently no available standard that is completely homogeneous and radiogenic. Glasses have the advantage of a uniform well-known composition and they are considered to be adequate provided their relative fractionation value is well established.

In order to determine relative Pb/U ablation fractionation of these glass standards versus calcite, a sample of calcite of known age was used. This is the Walnut Creek calcite, collected by Troy Rasbury (Stony Brook University) and obtained from Randy Parrish (Natural Environment Research Council isotope lab, UK). The age of this calcite is about 254 Ma (Parrish, pers. comm.). It has fairly high U concentrations and low (although not insignificant) common Pb. This comparison was carried out using both 213 nm and 193 nm lasers in order to also establish the optimal laser wavelength for the analyses.

### 2.1.1 213 nm Laser

The NIST610 standard shows a 33% fractionation of Pb/U ratios relative to calcite using the 213nm laser (Figure 3A). The NIST612 standard also shows a significant fractionation of about 23% (Figure 3B). Data show significant scatter about the mean so these numbers are approximate.

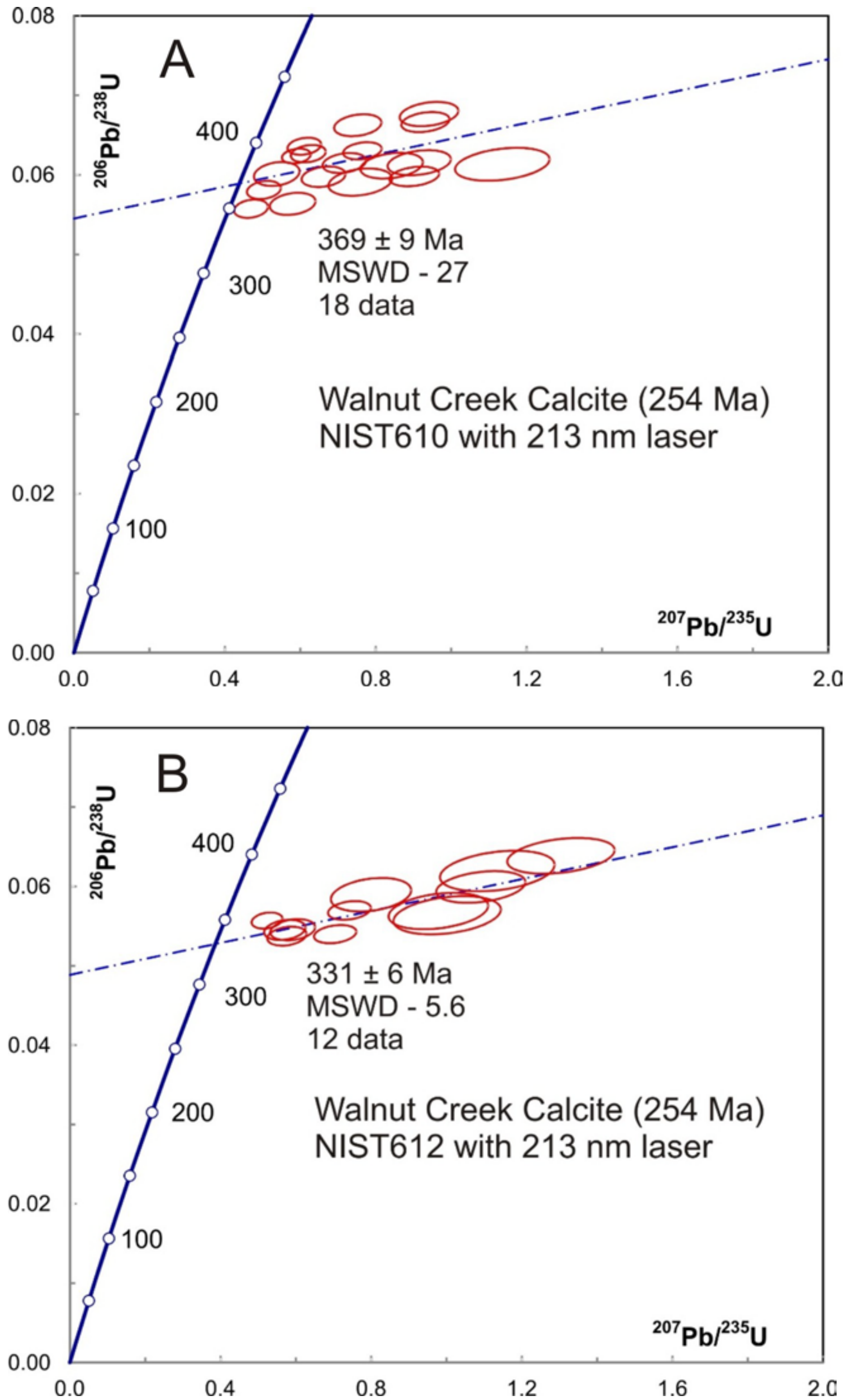



**Figure 3: A) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST610 Standard Ablated with a 213 nm Laser Beam. B) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST612 Standard Ablated with a 213 nm Laser Beam**

### 2.1.2 193 nm Laser

The NIST610 standard shows no detectable fractionation under the 193 nm laser, giving an age of 255 ± 7 Ma (Figure 4A). The NIST612 standard gives a slightly higher age of 262 ± 8 Ma (Figure 4B). Given the degree of scatter, it was provisionally decided to set the fractionation correction at zero for this standard as well. Note that this experiment was run with the same data set calibrated against the two standards.

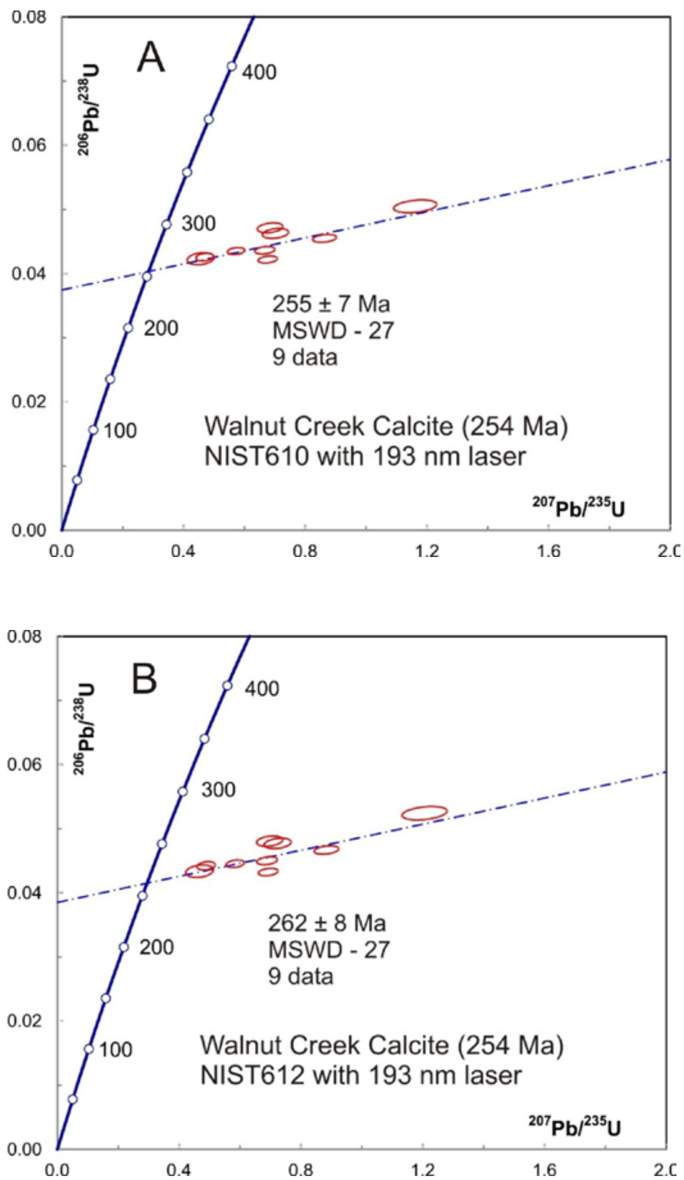



**Figure 4: A) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST610 Standard Ablated with a 193 nm Laser Beam. B) U-Pb Concordia Data on the Walnut Creek Calcite Using the NIST612 Standard Ablated with a 193 nm Laser Beam**

The ablation characteristics of the NIST610 and NIST612 glasses are somewhat different. NIST612 requires a higher laser power density to ablate evenly because it is a more pure glass with 37 parts per million (ppm) U, whereas NIST610 is heavily doped with trace elements (462 ppm U) and couples to the laser at about the same power density as calcite. However, NIST610 is closer to calcite samples in terms of U concentration. Analyses using the even more dilute NIST614 glass also show no Pb/U ablation fractionation relative to calcite using the 193 nm laser (R. Parrish, pers. comm.). Ablation is thought to be more efficient at shorter laser wavelengths. With incomplete ablation a portion of the sample may be melted and blown around the ablation pit. Melts are likely to retain U but lose most of the Pb because of its high volatility, thus leading to an increase in measured $^{206}Pb/^{238}U$ ratio. In addition, only about half of the calcite is converted to $CO_2$ with the 213 nm laser (Münsterer et al., 2011), which can produce explosive disaggregation, leading to signal spikes that must be removed. The 193 nm laser converts most of the sample into $CO_2$ resulting in much more even ablation with less residual melt. The comparison indicates that all future laser ablation work on secondary calcite should be carried out using a 193 nm or shorter laser wavelength.

Based on the above analyses, fractionation bias corrections for previous and current analyses have been set at -33% for NIST610-based analyses using the 213 nm laser and -23% for NIST612-based analyses with the 213 nm laser. Previous (Davis, 2013) data have been recalculated using these values and the updated results are presented below. A numerical error in the $^{206}Pb/^{238}U$ value previously used for the NIST612 standard fortuitously cancelled the fractionation bias so that previously quoted ages using this standard are close to unchanged, whereas previous ages using the NIST610 standard are reduced by a third.

## 2.2 LA-ICPMS DATA REDUCTION

The LA-ICPMS data presented herein were calculated using software which bases mean ages on the sum of counts in an analytical time-resolved profile rather than the average of ratios, which was the previously employed method. This data reduction method is a more statistically robust approach (Ogliore et al., 2011) for the analysis of secondary calcite as it is common for signal intensity to approach baseline and for data to be noisy.

Data acquisition involves collecting hundreds of cycles of $^{207}Pb$, $^{206}Pb$ and $^{238}U$ measurements (about 150 ms per cycle) as the beam penetrates deeper into the sample and displaying the ratios in a time-resolved profile. The traditional approach to data reduction is to define an acceptable window within the data profile and average the ratios. Calcite typically has low (<1 ppm) U concentrations and the most useful samples for dating are those with very low initial common Pb concentrations so that a significant proportion of the Pb is radiogenic. Relatively young (<100 Ma) radiogenic samples will have much lower Pb concentrations than U.

When a signal approaches baseline ratios it becomes unstable since a near-zero measured value in the denominator will cause the apparent ratio to increase without limit. This causes the average to skew toward higher values. One way to prevent this is to base the average ratio on the sum of total counts in the numerator and denominator peaks. A limitation is that calculation of standard deviations cannot be based on the scatter of individual measurements as in the ratio average approach. A standard deviation for a ratio can only be calculated based on the root-mean-square of the errors in the individual peaks, which are $1/\sqrt{N}$ where N is the number of counts in each peak. This will be a minimum estimate of the true standard deviation. The total standard deviations (sigma) for concordia coordinates and their cross correlations (rho) are determined by increasing each input parameter (measured sample and standard ratios) by one sigma, calculating the results and then taking the root-mean-square values of the deviations of these results from the means to produce variances and covariance for the mean concordia coordinate values.

In addition, when collecting laser ablation data from calcite using a 213 nm laser there are often numerous spikes, particularly on the Pb isotopes, possibly due to the explosive nature of the ablation process. Therefore, many data sets have to be heavily edited. In the ratio averaging approach, anomalously high or low $^{207}Pb/^{206}Pb$ and $^{206}Pb/^{238}U$ ratios can be edited out independently. In the peak summing approach, peaks rather than ratios are edited and the rejection of one peak requires removal of all other peaks in the cycle. In most cases anomalous spikes are much higher than surrounding signals so the choice of which ones to edit is obvious, but this is not always the case so there is the danger of over-editing, which could bias data. The current software version has an 'auto edit' feature that allows peaks to be edited out to a chosen multiple of a standard deviation ($1/\sqrt{N}$).

Time resolved profiles of ratios for zoned calcite often show variable $^{207}Pb/^{206}Pb$ and $^{206}Pb/^{238}U$ values, which may be due either to variable age or to variations in the ratio of U to initial common Pb. A feature of the new software is that it presents a time-resolved profile of model ages. Where data are sufficiently precise, this allows resolution and averaging of specific age zones. The new software appears to result in more consistent and statistically robust ages. Meaningful age information can be extracted even when Pb signals are only a few counts in each cycle.

Reduced data are plotted and averaged using Isoplot (Ludwig 2003). Ages and error ellipses are given at 2 sigma unless otherwise noted.

### 2.3 ID-TIMS METHOD

Relatively large crystals with well-defined LA-ICPMS ages are preferred for ID-TIMS analyses. Crystals are fixed onto warm parafilm to shield broken basal surfaces and dissolved in 2 or 3 stages. The dissolved fractions are spiked and processed separately to determine any age differences between the interior and exterior portions of crystals.

Grains are slightly leached in dilute CLR solution to remove surface Pb contamination. They are then weighed and the volume of 3N HCl necessary to dissolve a given fraction of the crystal calculated. This volume is then applied to the crystal in a clean air box beneath a microscope. After bubbling ceased, the liquid is withdrawn and transferred to a 0.5 ml centrifuge tube, along with $^{205}Pb$-$^{233}U$-$^{235}U$ spike solution (Earthtime ET535). Several drops of 9N HBr are added to the liquid in the centrifuge tube. HF is then added to precipitate Ca. It is important that precipitation occur in the presence of excess $Br^-$ or $Cl^-$ anions (hence the HBr) so that dissolved Pb is complexed, since uncomplexed $Pb^{+2}$ will co-precipitate with $CaF_2$. The tubes are then centrifuged and the liquid drawn off with a pipette, evaporated and converted to 2N HBr for chemistry in 50 microlitre anion exchange columns following the method of Krogh (1972). Isotope analysis is carried out using a Daly collector on an MM354 mass spectrometer.

## 3. LA-ICPMS RESULTS

LA-ICPMS results presented below include data previously presented in Davis (2013) that has been recalculated using the correct fractionation bias corrections and data reduction program described above (Section 3.1). These data are presented in Appendix A1 along with new data on sample DGR-3-034. Results on new samples from deeper levels are calculated using the same corrections and data reduction program and presented in Section 3.2 and Appendix A2. Data in section 3.1 were acquired entirely on the 213 nm laser using either NIST610 or NIST612 standards as noted in the headings of Appendix A1. Data in Section 3.2 were acquired on either the 213 nm or 193 nm laser using only the NIST610 standard, also noted in the headings to Appendix A2.

### 3.1 RECALCULATION OF PREVIOUS LA-ICPMS DATA

Results originally presented in Davis (2013) have been recalculated using the updated data reduction method described above in Section 2.2. Recalculated data from calcite filling northeast trending fractures at surface (DD12-11NE) are shown on Figure 5A and listed in Appendix A1. The mean regression age is 71 ± 6 Ma on a set of the 35 most radiogenic data but the MSWD is 16 indicating scatter well outside of error. The model ages from the most precise and radiogenic data ($^{207}Pb/^{235}U$ ages less than 300 Ma) range from 60 ± 4 Ma to 89 ± 6 Ma, suggesting that the ablation pits sampled zones of variable age.

Data from southeast trending fractures at surface (DD12-12SE) are shown on Figure 5B. The majority of data define a mean model age of 89 ± 3 Ma but with significant scatter. A small subset of data show distinctly younger ages, the youngest and most radiogenic giving a 58 ± 2 Ma model age.

A sub-horizontal set (flat veins, DD12-12FV) gave similarly scattered U-Pb data suggesting a possibly trimodal age distribution (Figure 5C). A fairly coherent older cluster gives a mean age of 88 ± 5 Ma with scatter only slightly outside of error (MSWD – 2 on 25 data). There is a small group of distinctly younger data, the most radiogenic of which gives a model age of 40 ± 2 Ma. An apparently coherent intermediate cluster may define an age of about 60 Ma but this may also be an artifact of mixing.

A north-trending set of fractures (DD12-13N) gave similar data to the others with most data ranging from about 60 Ma to 85 Ma (Figure 5D). A small subset gives a distinctly younger age of 40 ± 3 Ma (MSWD – 0.9, 5 data).

A great deal of work was done on calcite from shallow brecciated veins and vugs collected from DGR drill hole number 3 at 34 m depth (sample DGR-3-034). Individual crystals were targeted on both natural surfaces and broken bases to see if there was evidence for age zonation. However, results are inconclusive. Plotting all data (Figure 6) shows a similar but somewhat wider range of ages compared to the surface samples. The oldest data define a model age of about 100 Ma although there are near concordant data at about 80 Ma, 40 Ma and possibly one datum at 25 Ma.

Most samples from Ordovician sections proved to be too low in U to obtain useful age information. One calcite vein sample from DGR-6-886.91B yielded a range of radiogenic data that define an age of 468 ± 25 Ma (MSWD – 1.3) on 6 analyses (Figure 7). This is a middle Ordovician age consistent with the time of deposition of the host rock.

Host dolostone material was found to have relatively high U concentrations but also high common Pb and did not yield useful age information (e.g. Appendix A1, analyses 255-260 from DGR-3-034).

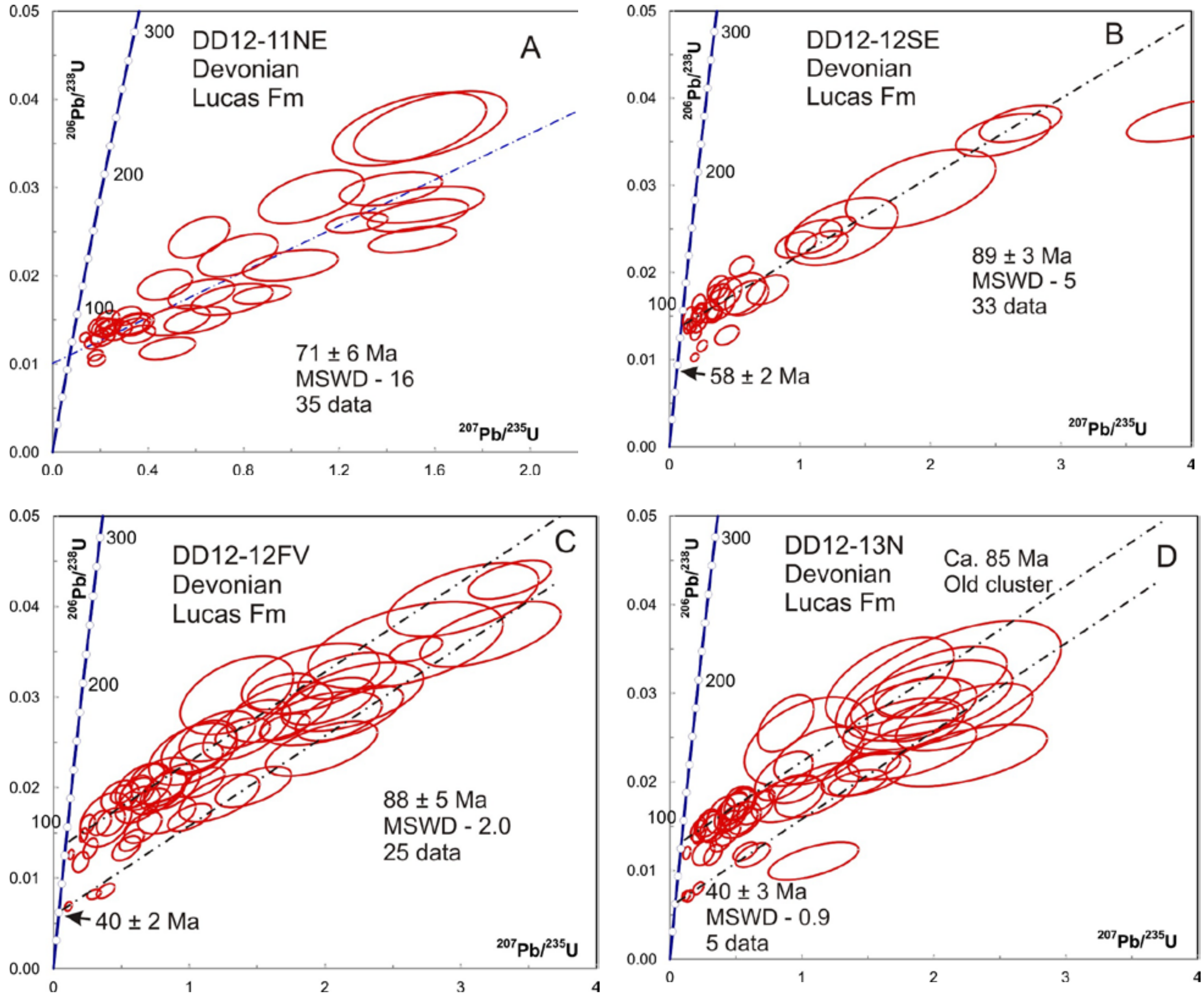



**Figure 5: A to D) U-Pb Concordia Data from Surface Vein Calcites Recalculated with New Software and Corrected for Calcite-Standard Glass Bias**

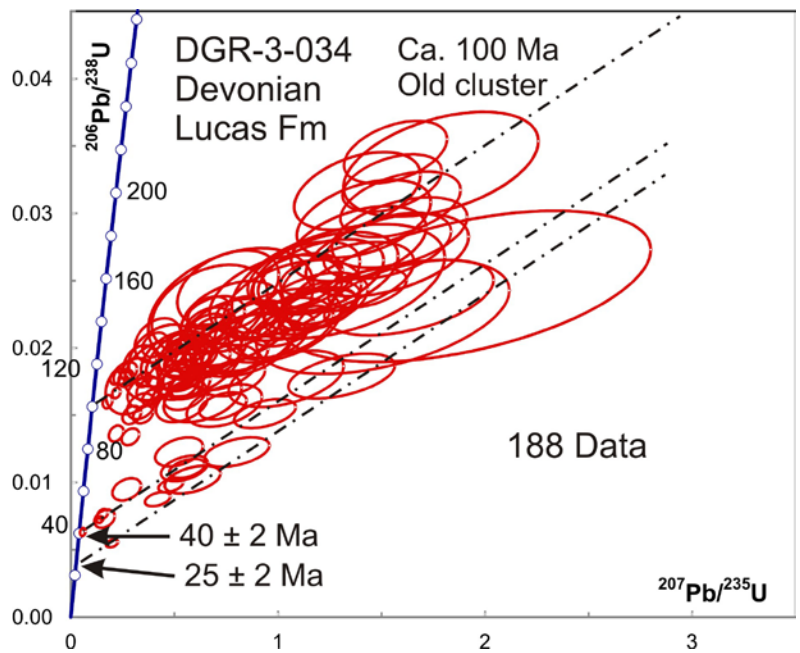



**Figure 6: U-Pb Concordia Data from Shallow Vein Calcites Recalculated with New Software and Corrected for Calcite-Standard Glass Bias. Lines are Approximate Visual Fits to Data Subsets**

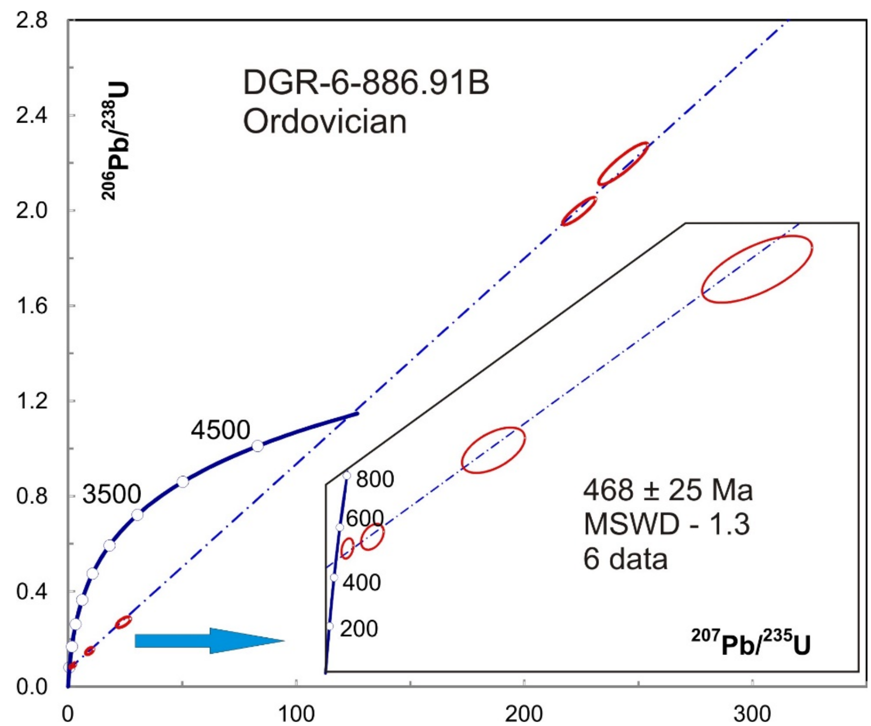



**Figure 7: U-Pb Concordia Data from Ordovician Vein Calcite Recalculated with New Software and Corrected for Calcite-Standard Glass Bias**

## 3.2 NEW LA-ICPMS DATA FROM DGR CORE

### 3.2.1 DGR-3-037.37 Devonian Lucas Formation

New U-Pb analyses from a shallow level calcite vein sample produced near-concordant data with a range of model ages from about 40-90 Ma (Figure 8). This approximately matches the range found in the previous dataset.

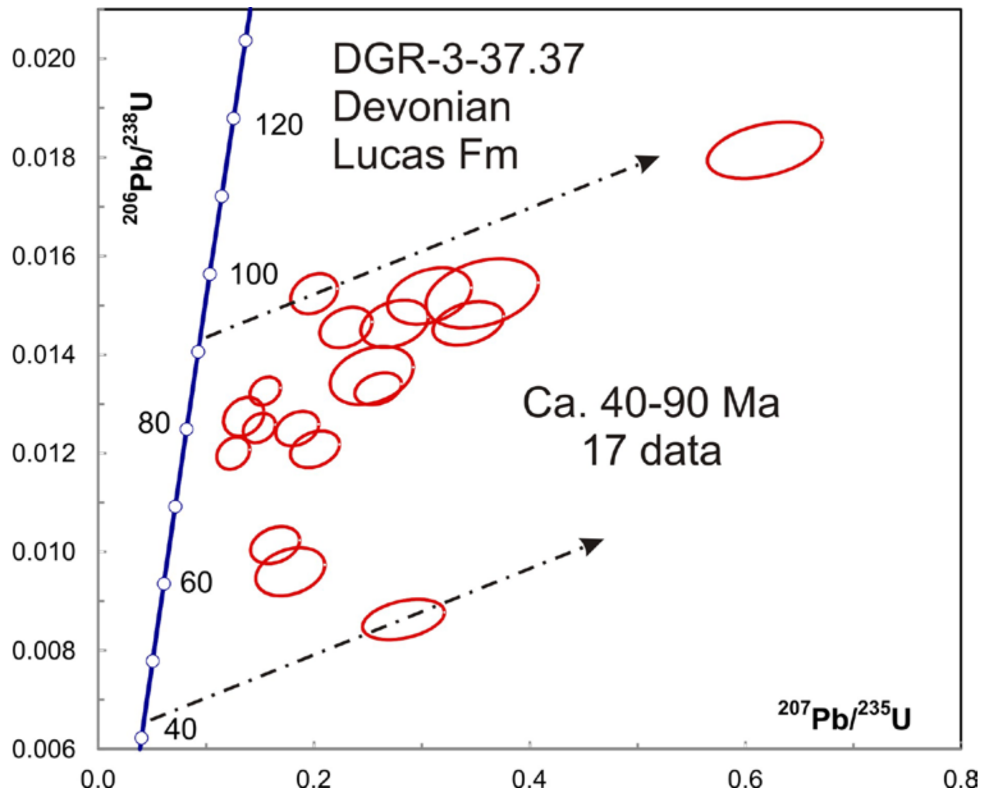



**Figure 8: U-Pb Concordia Data from Sample DGR-3-037.37 Vein Calcites**

### 3.2.2 DGR-4-073.73 Devonian Amherstburg Formation

U-Pb data from this sample shows no evidence for the >50 Ma ages that are abundant at higher levels. Near concordant data show a range of ages (Figure 9) but these cover a younger range of 27-46 Ma. Six of the youngest data define a mean age of 28 ± 2 Ma with some scatter.

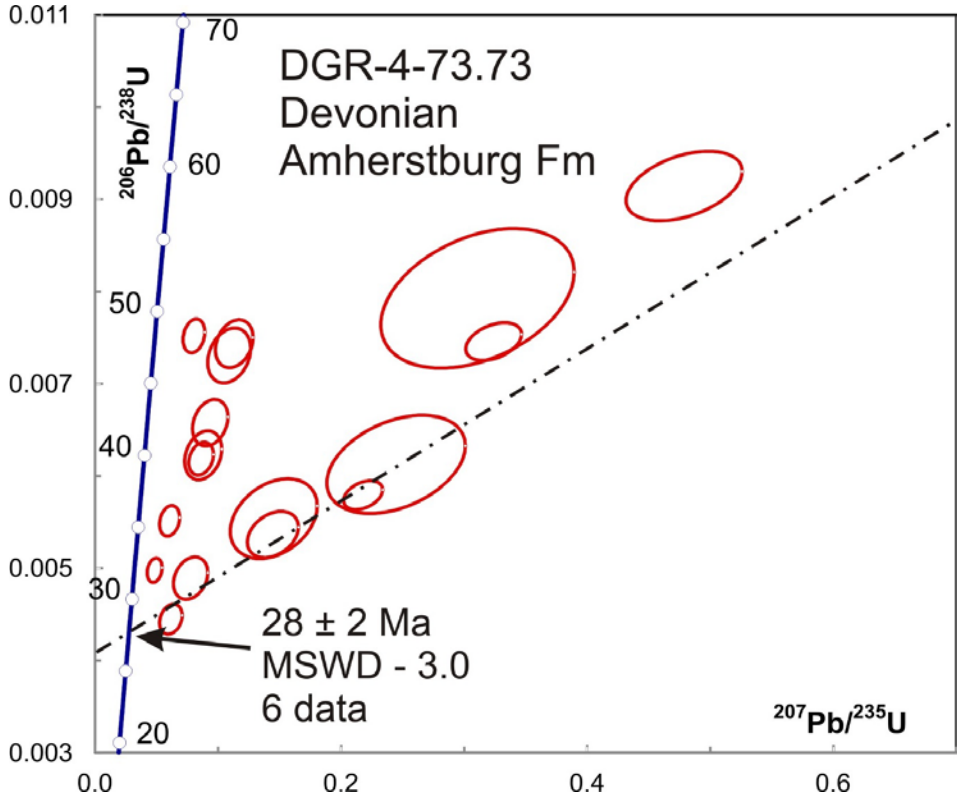



**Figure 9: U-Pb Concordia Data from Sample DGR-4-073.73 Vein Calcites**

### 3.2.3 DGR-3-096.59 Devonian Bois Blanc Formation

Although this sample shows relatively high U levels, its Pb is generally only weakly radiogenic. Only 5 analyses were done on this sample, one of which gave a slightly discordant datum with a model age of 26 ± 2 Ma.

### 3.2.4 DGR-1-113.55 Devonian Bois Blanc Formation

In this sample, calcite grains coat surfaces in irregular fractures that are near vertical (Figure 10A). Crystal faces were targeted in addition to broken surfaces to resolve the youngest component. Data are highly variable in terms of radiogenicity but the more concordant data appear to consist of two age components, one being about 50 Ma and the other nearly 0 Ma

(Figure 10B). Most of the data in the younger (<50 Ma) arrays are from crystal faces whereas all other data are from broken or cleaved surfaces. A polished grain that showed zoning under back-scattered electron imaging (Figure 11A) was targeted but proved to be of one age. Analyses show a wide range of discordance but are collinear with an age of 0.7 ± 1.5 Ma (Figure 11B).

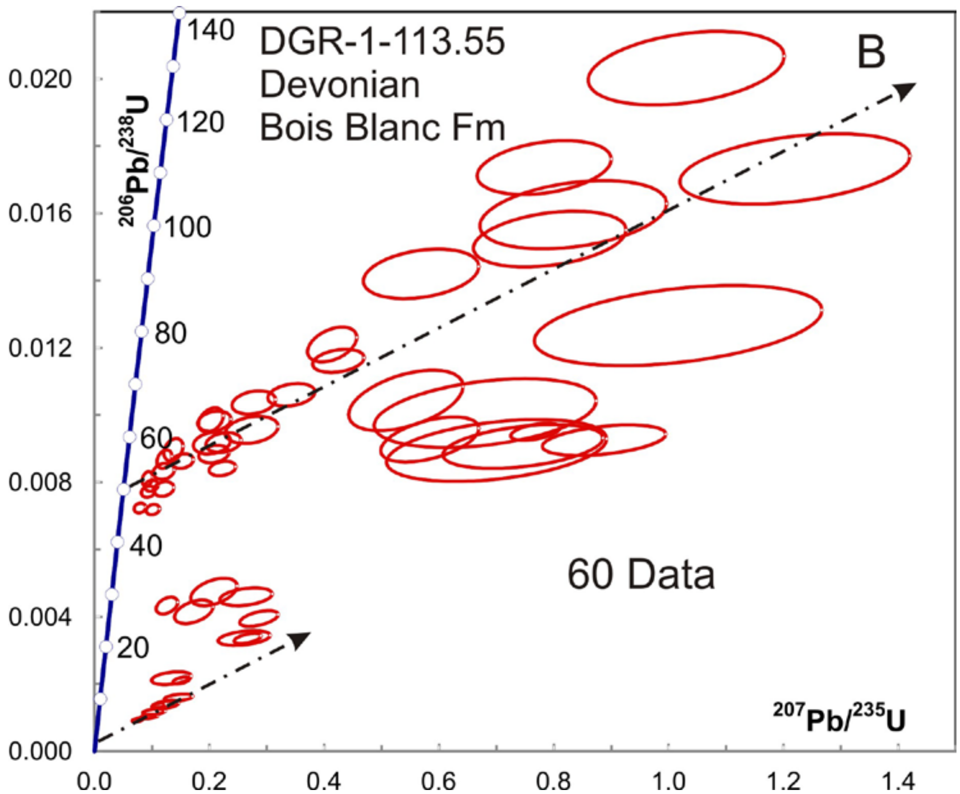
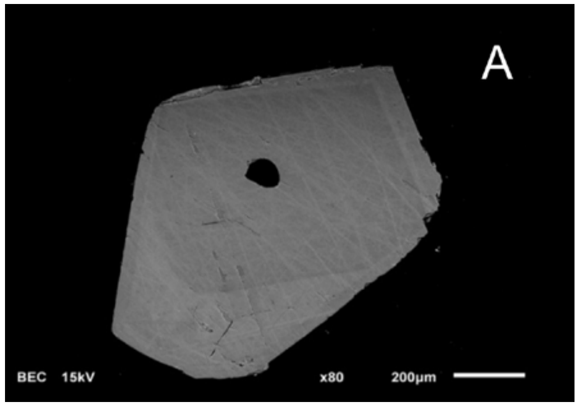




**Figure 10: A) Exposed Face of Sub-Vertical Calcite-Coated Fracture in DGR-1-113.55 Core Sample. B) U-Pb Concordia Data from Sample DGR-1-113.55 Vein Calcites with Approximate Contamination Lines. Most of the Data in the Younger (<50 Ma) Arrays are From Crystal Faces**



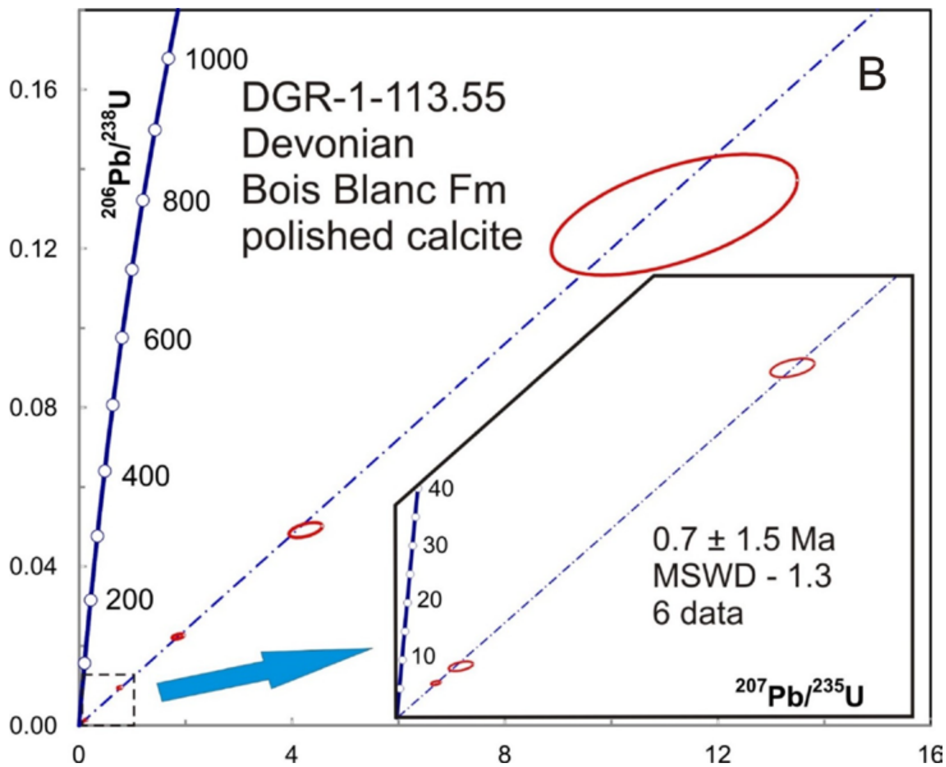




**Figure 11: A) BSE Image of a Polished Vein Calcite Grain from Sample DGR-1-113.55. Data for this Grain is Shown Below. B) U-Pb Concordia Data on a Single Polished Vein Calcite Grain from Sample DGR-1-113.55**

### 3.2.5 DGR-3-113.17 Devonian Bois Blanc Formation

As with most samples, calcite grains coat surfaces in near vertical fractures (Figure 12A). This sample again gave evidence for multiple generations of calcite growth. Near concordant data give model ages that scatter from 11 Ma to 24 Ma while more discordant imprecise data suggest older components that are 50-70 Ma in age (Figure 12B). Most of the younger data shown in the inset are from crystal faces whereas all others were from broken or cleaved surfaces. The older analyses show relatively high Th/U ratios (Appendix A2, analyses 122-129) whereas the younger analyses show relatively high U concentrations of several ppm.

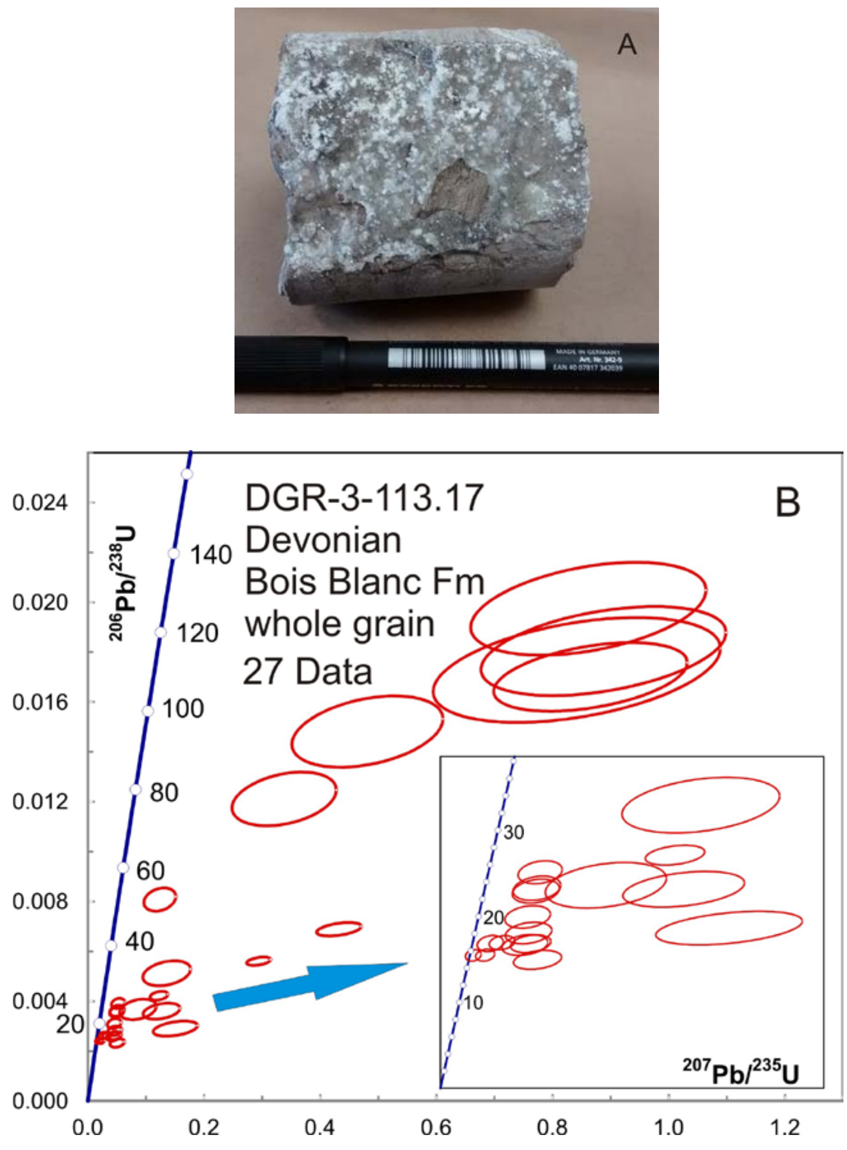



**Figure 12: A) Exposed Face of Sub-Vertical Calcite-Coated Fracture in DGR-3-113.17 Core Sample. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-3-113.17. All but Four of the Younger Data Shown in the Inset were from Crystal Faces**

### 3.2.6 DGR-1-120.18 Devonian Bois Blanc Formation

The 8 most concordant data from this sample are consistent with a single age of 46 ± 3 Ma (Figure 13). This calcite shows anomalously high Th/U ratios, like the ca. 50 Ma component from DGR-3-113. Three other analyses (Appendix A2, analyses 135-137) show much higher U values and low Th/U but are only weakly radiogenic (off scale in Figure 13). These give model ages of about 250 Ma.

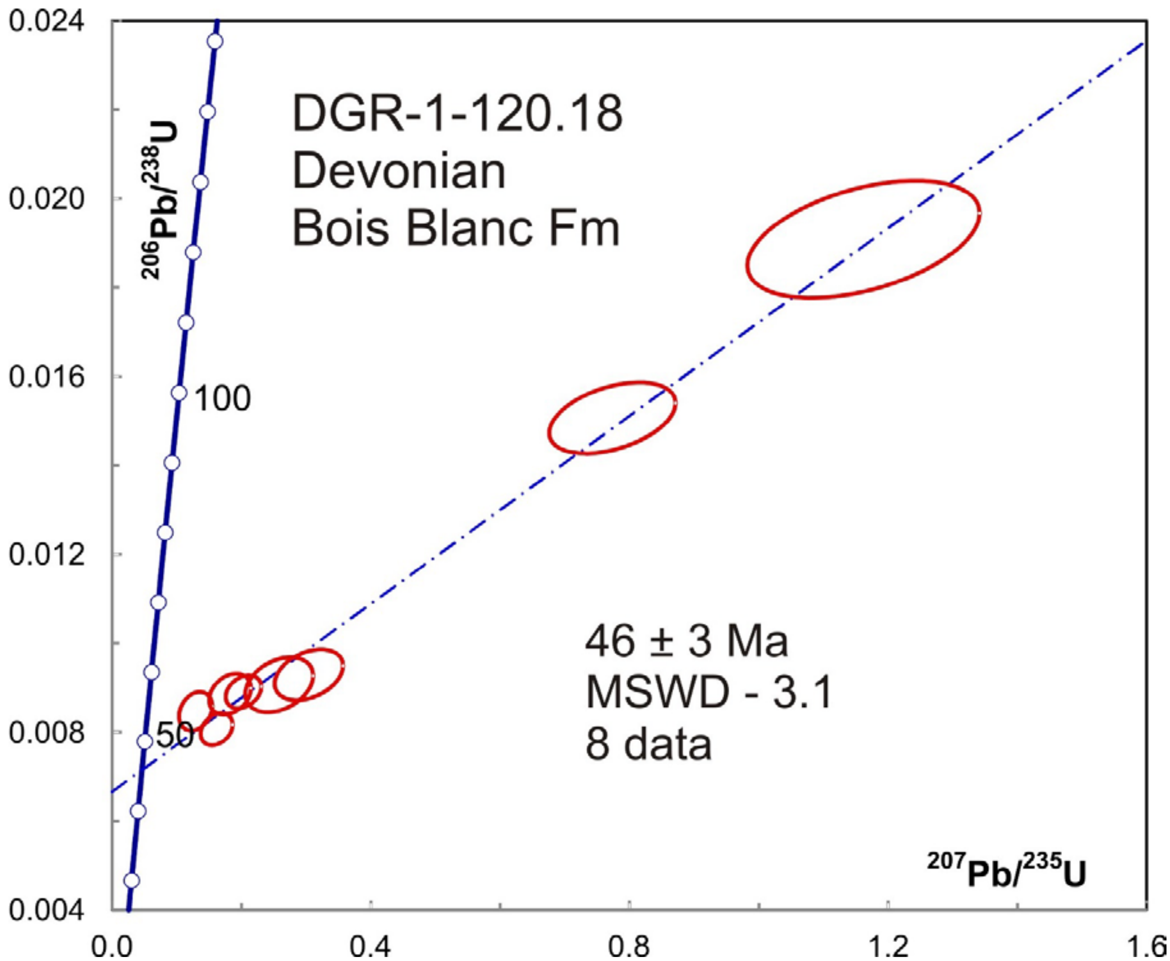



**Figure 13: U-Pb Concordia Data on Vein Calcite from Sample DGR-1-120.18**

### 3.2.7 DGR-3-133.17 Devonian Bois Blanc Formation

This sample consists of small clear crystals from narrow irregular subvertical fractures. Although the aggregate data define a mean age of 11 Ma, the more precise and concordant data appear to form two groups with ages of about 8 Ma and 12 Ma (Figure 14).

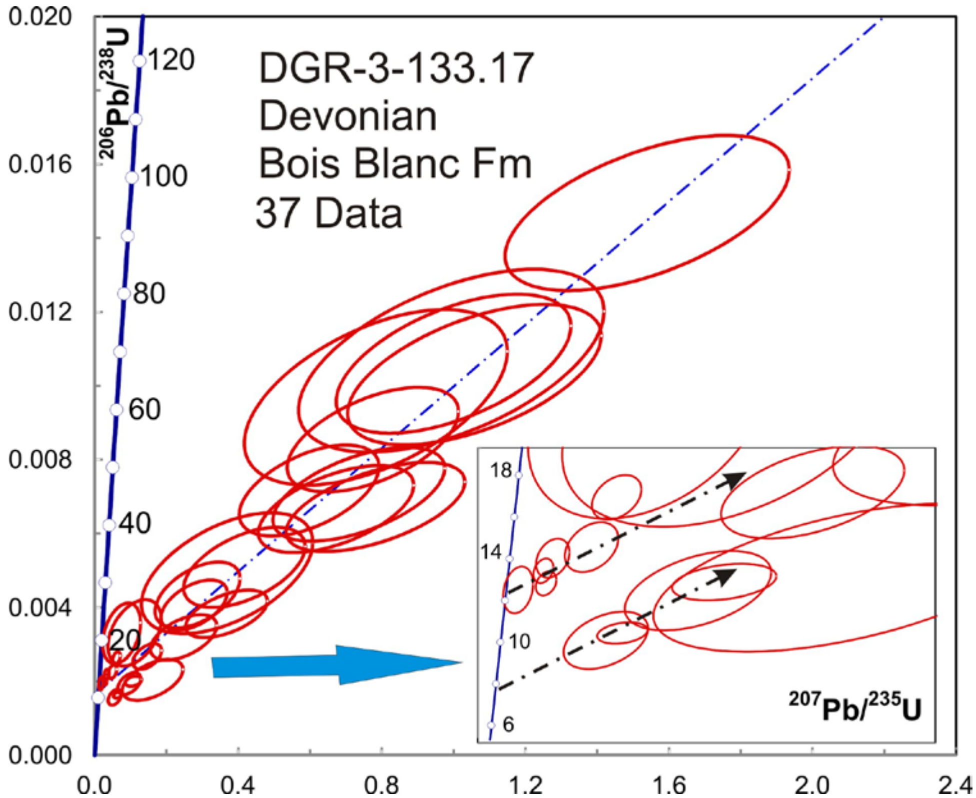



**Figure 14: U-Pb Concordia Data on Vein Calcite from Sample DGR-3-133.17. Contamination Lines are Approximate.**

### 3.2.8 DGR-3-162.07 Silurian Bass Islands Formation

Only two analyses were carried out on this sample, which proved to have very low U concentrations and failed to yield model ages (Appendix A2, analyses 195-196).

### 3.2.9 DGR-3-180.06 Silurian Bass Islands Formation

This sample contains irregular openings splaying off of sub-vertical fractures (Figure 15A). Ten data from this sample are consistent with an age of 18.1 ± 1.4 Ma (Figure 15B) although with some excess scatter (MSWD – 3.8). This age is largely controlled by two near-concordant data.

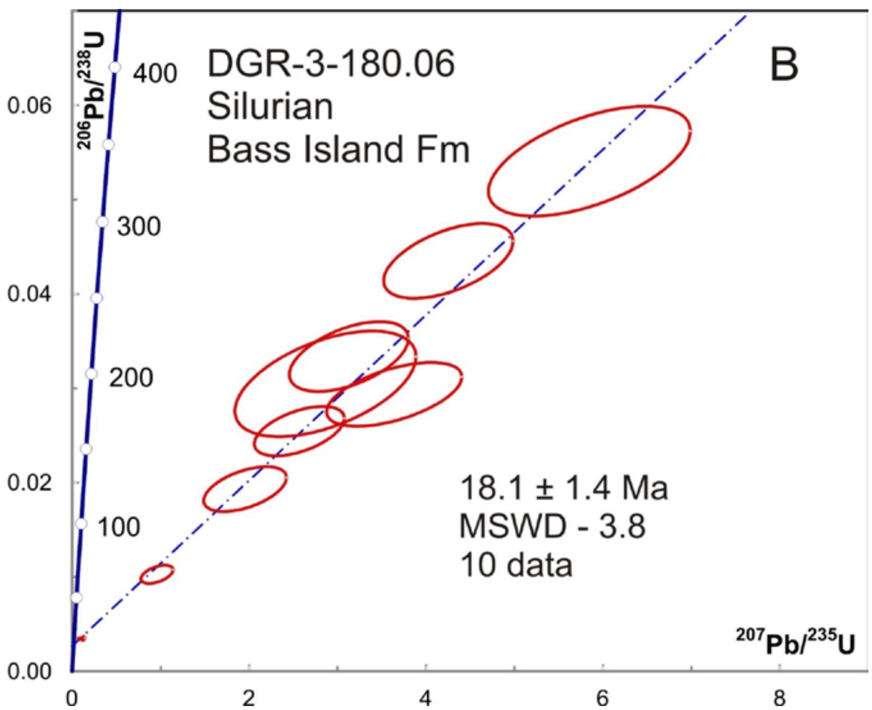




**Figure 15: A) Calcite-Filled Opening in Core Sample DGR-3-180.06. B) U-Pb Concordia Data on Vein Calcite from Core Sample DGR-3-180.06**

### 3.2.10 DGR-3-186.43 Silurian Bass Islands Formation

This sample was collected from a calcite-filled vug (Figure 16A). Although data were collected from both crystal faces and broken basal sections, all data appear to be consistent with a single age of 7.6 ± 0.3 Ma (MSWD – 4.1, Figure 16B).

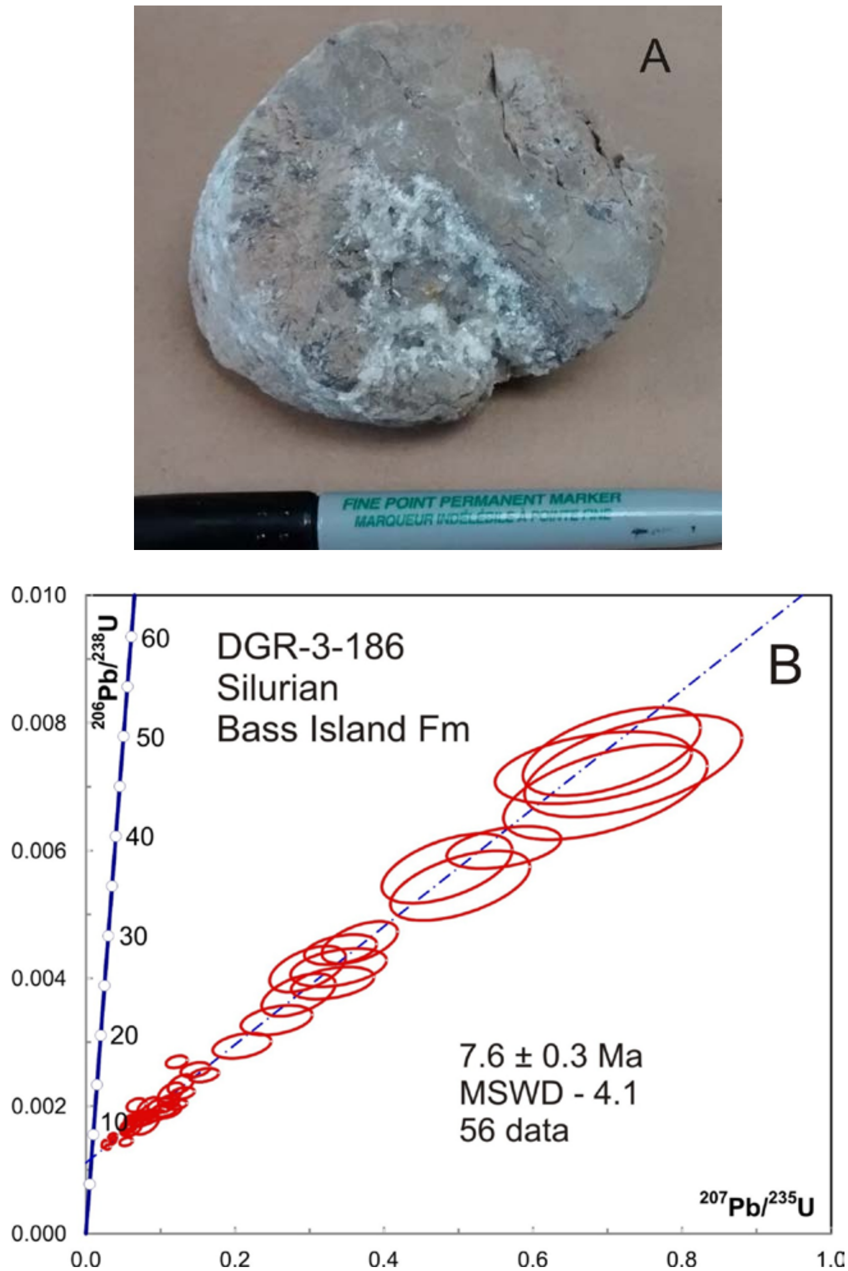



**Figure 16: A) Calcite-Filled Vug from DGR-3-186.43 Near Base of the Bass Islands Formation. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-3-186.43**

### 3.2.11 DGR-4-344.18 Silurian Salina A-1 Carbonate

This sample was distinct from the others in having a set of sub-horizontal calcite filled fractures (Figure 17A). A set of 7 analyses defines a Pb contamination line with an age of 318 ± 10 Ma (MSWD – 3.1, Figure 17B). Four other analyses scatter toward ages as young as approximately 140 Ma.

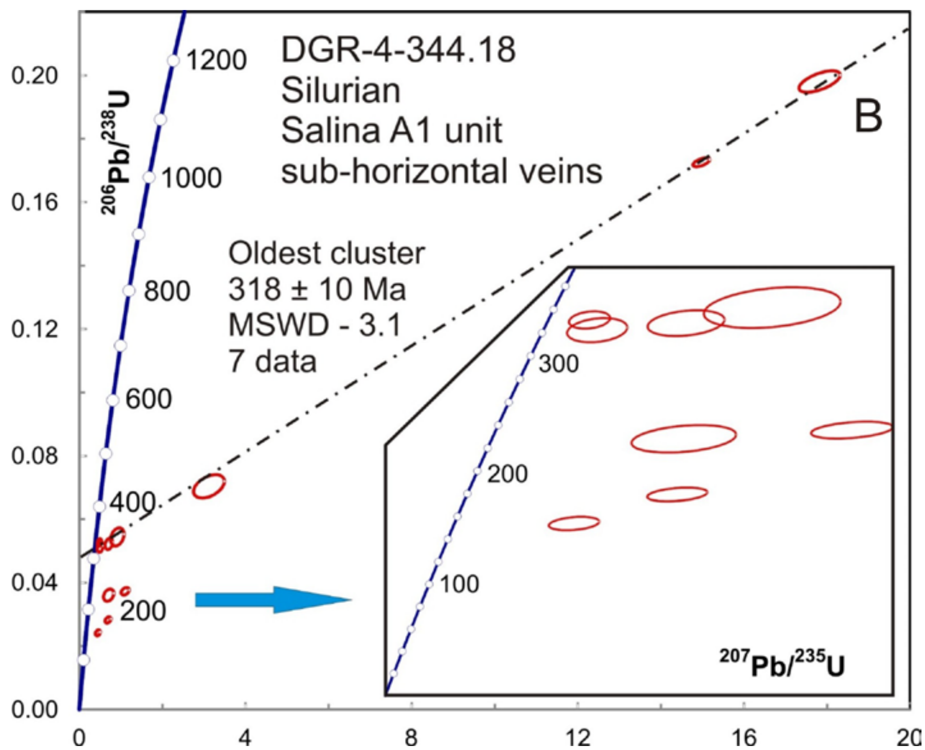




**Figure 17: A) Predominantly Horizontal mm-Scale Calcite Veins with a Few Vertical Veins from DGR-4-344.18 in the Silurian Salina A-1 Carbonate Unit. B) U-Pb Concordia Data on Vein Calcite from Sample DGR-4-344.18**

## 4. ID-TIMS RESULTS

Results of all successful U-Pb analyses by ID-TIMS are reported in Appendix A3 and shown on Figures 18A and 18B. For convenience, this includes analyses from previous reports (Davis 2013) (labeled with dwd analysis numbers in Appendix A3).

All data are well within error of concordia after correction for the common Pb component. $^{206}Pb/^{238}U$ ratios give the most precise age estimates and these will be quoted. LA-ICPMS ages are roughly in agreement with ID-TIMS ages where both are available on the same grain. One exception is Grain 2 from DD12-12FV which gives younger ages by both LA-ICPMS and ID-TIMS.

The ID-TIMS data set from surface and near-surface samples (Figure 18A) is sparse compared to that from LA-ICPMS but the overall age pattern is similar (compare with Figures 19A and 19B below). Most ID-TIMS analyses group around about 90 Ma but ages scatter well outside of error suggesting that crystal growth occurred over a substantial time span of about 80-110 Ma either as the result of a continuous process or due to multiple events. Some of the age spread is probably due to mixing with one or more younger phases. This was tested by dissolving and analyzing some crystals in stages. Care was taken to ensure that dissolution progressed from the crystal faces inwards by covering broken basal surfaces with parafilm. However, the integrity of the seal may be compromised after dissolution becomes advanced.

One grain from DD12-13N showed a progression from 73 ± 5 Ma to 104 ± 2 Ma over three dissolution stages as did a grain from DGR3-034, which gave 82 ± 1 Ma for the outer part versus 98 ± 1 Ma for the inner part. However, another grain from DD12-16, a loose unoriented sample collected at surface, shows a highly anomalous old but negatively discordant datum for the first wash, 91.4 ± 0.4 Ma for the second, and the youngest age of 88.2 ± 1.8 Ma for the third. Nevertheless the data show extended age zonation in the calcite crystals and suggest that ages from most whole grain dissolutions are likely to represent mixtures of younger and older components.

ID-TIMS results on deeper near-surface samples (Figure 18B) confirm the presence of younger age components, although these do not always agree with ages from LA-ICPMS. Two-stage dissolutions on each of two grains from DGR-1-113 yield the same 55 Ma ages for the cores, which roughly agree with an estimate of the older age component from LA-ICPMS (Figure 10B). The overgrowth ages of 9 Ma and 17 Ma are older than the ca. 0 Ma age component found by LA-ICPMS. They probably contain some proportion of the older component. Whole grain dissolution of DGR-3-180 gives an age of 60 ± 4 Ma, which is much older than the 18 Ma given by ID-TIMS (Figure 15B), although this is heavily dependent on just 2 radiogenic data. Two-stage dissolution of a grain from DGR-3-186 gives 10 Ma and 14 Ma, although LA-ICPMS gave an apparent age of about 8 Ma (Figure 16B), so there may be older components.

A whole grain dissolution from DGR-4-344 gives an age of 313 ± 1 Ma, in good agreement with the LA-ICPMS age of 318 ± 10 Ma for the older component (Figure 17B), while an imprecise age from a deeper Ordovician vein gives 451 ± 38 Ma (Appendix A3).

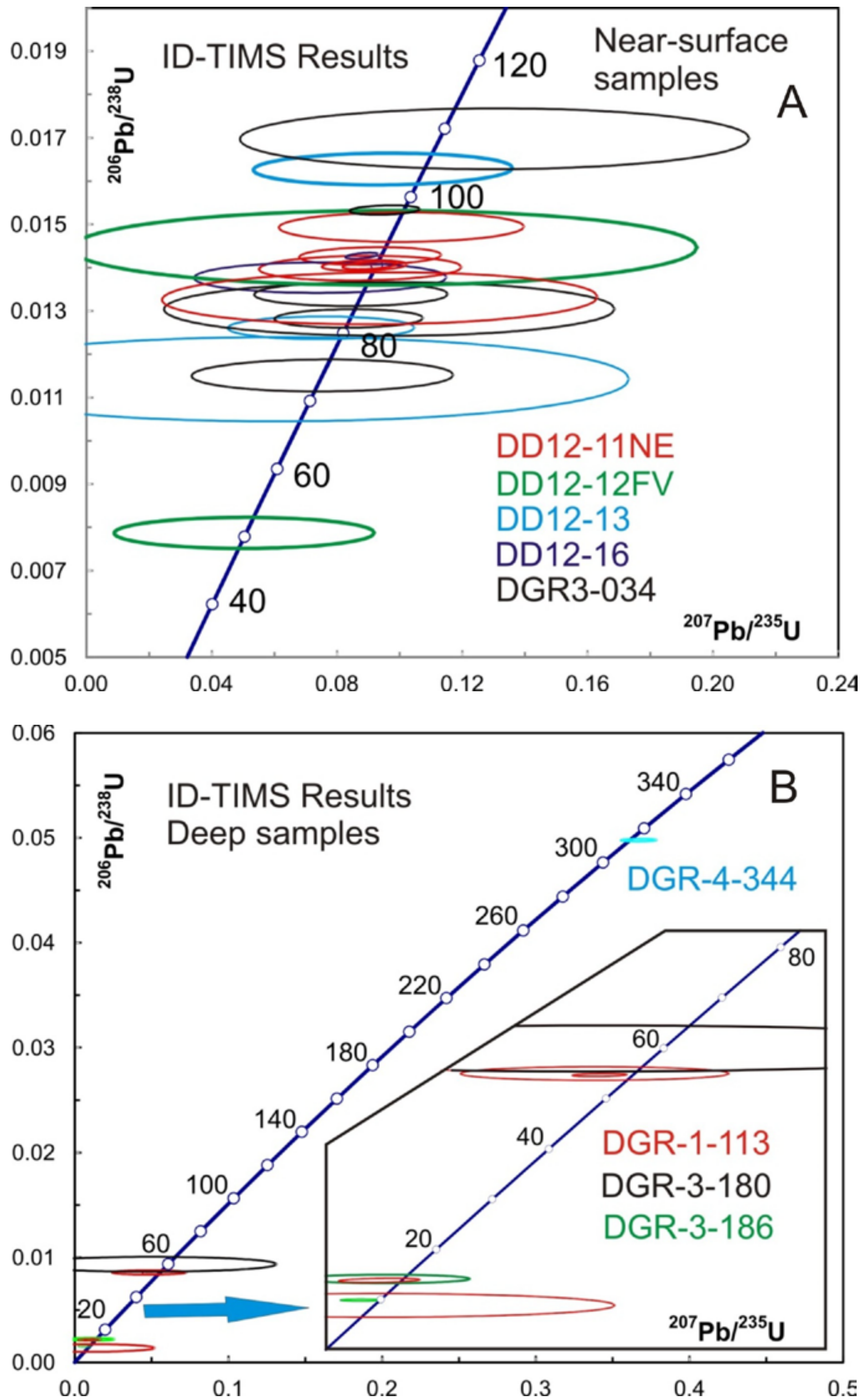



**Figure 18: A) U-Pb Concordia Data Measured by ID-TIMS on Vein Calcite from Surface and Near-Surface Samples Collected from Devonian and Silurian-aged Bedrock. B) U-Pb Concordia Data Measured by ID-TIMS on Vein Calcite from Devonian and Silurian-aged Bedrock**

## 5. DISCUSSION

The new data, based on analysis of 15 secondary near-surface calcite samples from Silurian and Devonian formations, reveal a complex history of fluid mobility and vein and vug emplacement ranging from late during the Paleozoic Era to the Pleistocene (Figure 19).

Plotting the probability density distribution of LA-ICPMS model ages from all surface samples gives a broad peak around 90 Ma with shoulders at about 100 Ma and 80 Ma and a distinct younger peak at 40 Ma (Figure 19A). For samples from the near-surface (e.g., DGR-3-034), the main distribution peaks at 100 Ma but with a slightly older shoulder and extends down to about 80 Ma. There is again a distinct younger peak at 40 Ma (Figure 19B).

Samples that extend down to approximately 180 metres vertical depth below ground surface in the Devonian and Upper Silurian sections show evidence for multiple events younger than the main growth event at surface (Figure 19C). At 73 m along borehole DGR-4 (DGR-4-73.73) ages range from about 46 Ma to 27 Ma. At 113 m along borehole DGR-1 (DGR-1-113) there is evidence for a distinct ca. 50 Ma growth event, as well as, one in geologically recent time (0.7 ± 1.5 Ma). Calcite from approximately the same depth in borehole DGR-3 (DGR-3-113) shows hints of a ca. 50 Ma event but the most recent growth gives U-Pb ages that scatter from about 24 Ma to about 11 Ma. Vein calcite from 120 m depth along borehole DGR-1 (DGR-1-120) seems to preserve evidence for a 46 ± 3 Ma growth event. There appears to be evidence for growth of a distinct high Th/U phase at ca. 50 Ma in DGR-3-113, DGR-1-120 and possibly a few of the analyses from DGR-1-113.

At 133 m along borehole DGR-3 near the base of the Devonian (DGR-3-133) there is evidence for two growth events at about 12 Ma and 7 Ma. Veins from the Upper Silurian (DGR-3-180) record 18 ± 1 Ma, based largely on two near-concordant analyses, while several meters deeper in the same borehole (DGR-3-186) calcite from a vug records a growth event at 7.6 ± 0.3 Ma with no evidence of any other ages.

In general, many of the results from the surface and near surface environment down to approximately 180 m vertical depth, appear to be the result of mixing between multiple generations of calcite but some appear to represent single or short-period events. Interestingly, the ca. 100 – 80 Ma ages are only evident in samples down to approximately 34 m vertical depth while ages down to ca. 0 Ma are found as deep as the Upper Silurian Bass Islands Formation (Figure 1). The entire shallow portion of the bedrock is within a zone of modern karst development beneath the Bruce nuclear site and, in addition, the top of the Bass Islands Formation is also recognized as a paleokarst horizon (Worthington, 2011).

In the Silurian Salina A-1 Carbonate Unit (DGR-4-344), sub-horizontal veins were filled with calcite at about 318 ± 10 Ma, at approximately the same time as the Mississippian to Pennsylvanian transition. Younger ages measured in this sample are scattered and may be the result of mixing with <100 Ma generations of calcite.

The samples collected from the Silurian Guelph Formation (e.g., DGR-3-391), as well as most of the deeper Ordovician samples analysed, proved to be too low in U to provide reliable age information. The only useful LA-ICPMS age data are from an Ordovician sample (DGR-6-886), in which vein calcite defines a much older age of 468 ± 25 Ma, while an ID-TIMS age on DGR-6-756 gave a similar age of 451 ± 38 Ma.

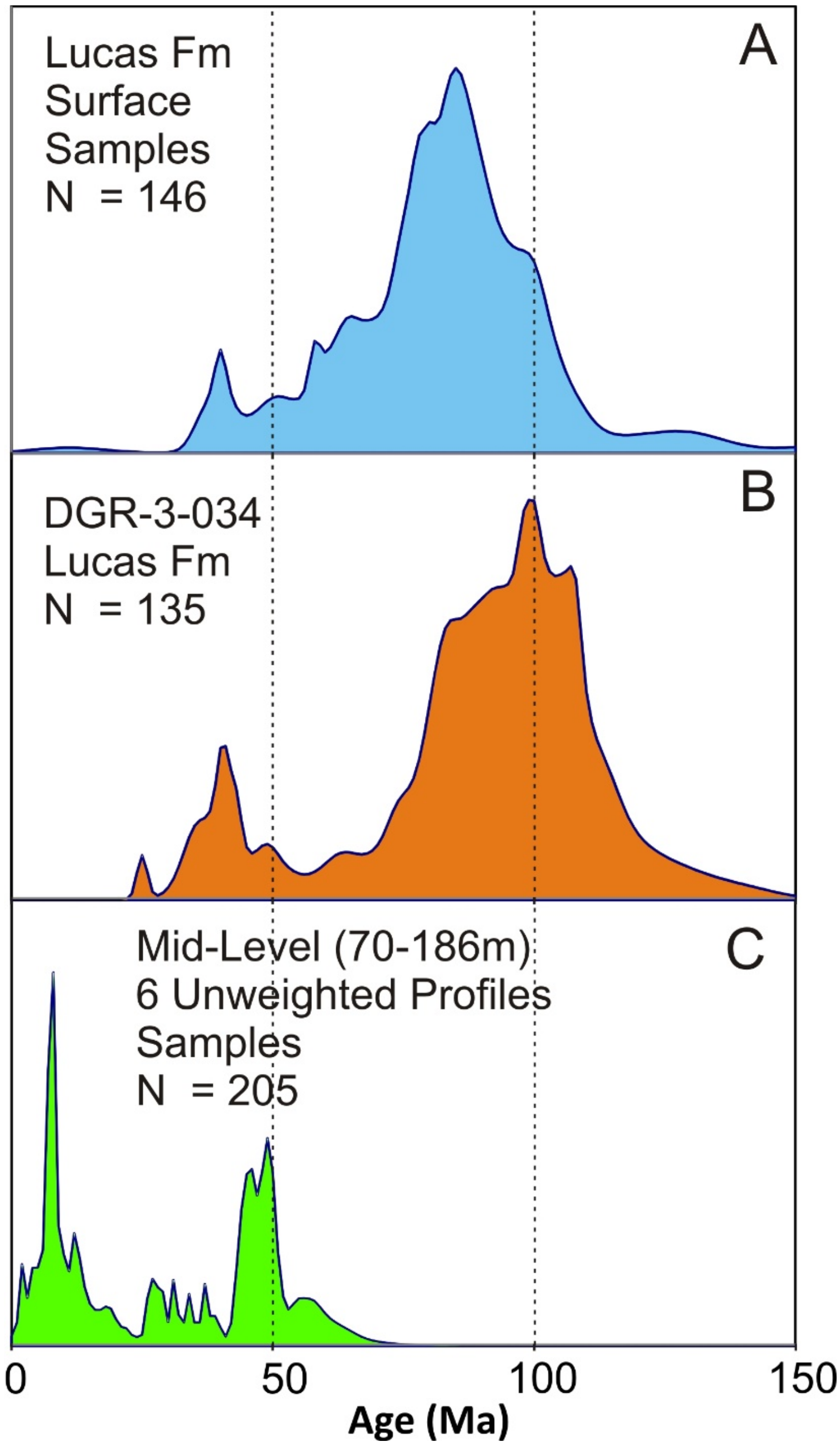



**Figure 19: A to C) Probability Density Distributions for LA-ICPMS Model Ages from Calcite Samples Down to Approximately 180 Metres Vertically Below Ground Surface**

## 6. SUMMARY

The results of the present study confirm the previous interpretation of Davis (2013) that the Ordovician sedimentary succession beneath the Bruce nuclear site remained isolated from post-Paleozoic geological perturbations that influenced the Devonian and Upper Silurian formations. New standard calibration factors refine previous LA-ICPMS age interpretations.

Secondary calcite in veins from the Devonian and Upper Silurian samples is much younger than the host rock and appears to have crystallized over an extended period of time between about 100 Ma and 0 Ma. In general, many of the results from the surface and near surface environment appear to be the result of mixing between multiple generations of calcite but some appear to represent single or short-period events. The youngest, Pleistocene, ages were identified in samples from the Upper Silurian Bass Islands Formation. The entire shallow portion of the bedrock is within a zone of modern karst beneath the Bruce nuclear site and, in addition, the top of the Bass Islands Formation is also recognized as a paleokarst horizon (Worthington, 2011).

Secondary calcite from the deeper Silurian Salina A1-Unit yields a fairly well-defined age of 318 ± 10 Ma, as well as, scattered younger ages. Based on available data, the deep Ordovician formations experienced one or more secondary calcite precipitation events dated in separate samples at 468 ± 25 Ma (LA-ICPMS) and 451 ± 38 Ma (ID-TIMS). These ages are contemporaneous with the timing of both sediment deposition and the Taconic Orogeny.

Refinements to the methodology described in Davis (2013), including the dependence of sample-standard bias on laser wavelength, indicate that future laser ablation work on calcite should be carried out using a NIST612 standard with a 193 nm wavelength laser.

## REFERENCES

Davis, D.W. 2013. Application of U-Pb Geochronology Methods to the Absolute Age Determination of Secondary Calcite. Nuclear Waste Management Organization report NWMO TR-2013-21, 31 pages. Toronto, Canada.

Intera. 2011. Descriptive Geosphere Site Model. Intera Engineering Ltd. report for the Nuclear Waste Management Organization NWMO DGR-TR-2011-24 R000. Toronto, Canada.

Jaffey, A.H., K.F. Flynn, L.E. Glendenin, W.C. Bentley and A.M. Essling. 1971. Precision measurement of half-lives and specific activities of 235U and 238U. Physical Review 4: 1889-1906.

Ludwig, K.R. 2003. User's manual for Isoplot 3.00 a geochronological toolkit for Excel. Berkeley Geochronological Center Special Publication 4, 71 p.

Münsterer, C. et al., 2011. Ion Beam Physics, ETH Zurich Annual Report p 26.

NWMO. 2011. Geosynthesis. Nuclear Waste Management Organization Report NWMO DGR-TR-2011-11 R000. Toronto, Canada.

Ogliore, R.C., G.R. Huss and K. Nagashima. 2011. Ratio estimation in SIMS analysis. Nuclear Instruments and Methods in Physics Research B 269: 1910–1918.

Worthington. 2011. Karst Assessment. Worthington Groundwater report for the Nuclear Waste Management Organization NWMO DGR-TR-2011-22 R000. Toronto, Canada.

# APPENDIX

## CONTENTS

**Page**

**APPENDIX A1 SUMMARY OF RECALCULATED LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE ....................33**

**APPENDIX A2 SUMMARY OF NEW LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE ....................49**

**APPENDIX A3 SUMMARY OF ID-TIMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE ...61**

## APPENDIX A1: SUMMARY OF RECALCULATED LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***DD12-11NE vein set*** | | | | | | | | | | | | | | |
| | **whole grain NIST-610** | | | | | | | | | | | | | | |
| 1 | DD12-11-3.1 | 1.7 | 0.055 | 0.003 | 2.772 | 0.290 | 0.0368 | 0.0023 | 0.59062 | 85 | 15 | 233 | 14 | 1348 | 76 |
| 2 | DD12-11-3.2 | 2.8 | 0.082 | 0.001 | 1.982 | 0.168 | 0.0342 | 0.0016 | 0.56444 | 114 | 10 | 217 | 10 | 1109 | 56 |
| 3 | DD12-11-3.4 | 3.2 | 0.102 | 0.014 | 1.582 | 0.131 | 0.0369 | 0.0016 | 0.53109 | 157 | 9 | 234 | 10 | 963 | 51 |
| 4 | DD12-11-3.5 | 3.2 | 0.323 | 0.007 | 10.629 | 0.487 | 0.1175 | 0.0033 | 0.61746 | 167 | 23 | 716 | 19 | 2491 | 42 |
| 5 | DD12-11-3.8 | 6.2 | 0.130 | 0.002 | 0.614 | 0.052 | 0.0243 | 0.0010 | 0.46237 | 129 | 6 | 155 | 6 | 486 | 32 |
| 6 | DD12-11-3.9 | 2.9 | 0.093 | 0.001 | 1.495 | 0.132 | 0.0366 | 0.0017 | 0.52527 | 160 | 10 | 232 | 11 | 928 | 52 |
| 7 | DD12-11-3.10 | 5.2 | 0.101 | 0.003 | 0.776 | 0.069 | 0.0223 | 0.0010 | 0.50377 | 105 | 6 | 142 | 6 | 583 | 39 |
| 8 | DD12-11-3.11 | 4.6 | 0.115 | 0.002 | 1.084 | 0.090 | 0.0290 | 0.0012 | 0.51382 | 132 | 7 | 184 | 8 | 745 | 43 |
| 9 | DD12-11-1.1 | 1.0 | 0.013 | 0.002 | 0.337 | 0.030 | 0.0145 | 0.0005 | 0.36661 | 78 | 3 | 93 | 3 | 295 | 22 |
| 10 | DD12-11-2.1 | 1.4 | 0.018 | 0.004 | 0.195 | 0.018 | 0.0143 | 0.0004 | 0.29694 | 86 | 2 | 92 | 2 | 181 | 15 |
| 11 | DD12-11-3B.1 | 1.7 | 0.019 | 0.002 | 0.171 | 0.015 | 0.0125 | 0.0003 | 0.29673 | 75 | 2 | 80 | 2 | 161 | 13 |
| 12 | DD12-11-4.1 | 0.6 | 0.010 | 0.022 | 0.470 | 0.047 | 0.0190 | 0.0007 | 0.37740 | 101 | 5 | 121 | 4 | 392 | 32 |
| 13 | DD12-11-5.1 | 0.8 | 0.020 | 0.007 | 1.530 | 0.087 | 0.0268 | 0.0008 | 0.49637 | 91 | 5 | 171 | 5 | 942 | 34 |
| 14 | DD12-11-6.1 | 3.8 | 0.043 | 0.008 | 0.135 | 0.009 | 0.0130 | 0.0002 | 0.26483 | 80 | 1 | 83 | 1 | 129 | 8 |
| 15 | DD12-11-6.2 | 1.1 | 0.014 | 0.003 | 0.338 | 0.026 | 0.0142 | 0.0004 | 0.36956 | 76 | 3 | 91 | 3 | 296 | 20 |
| 16 | DD12-11-7.1 | 0.6 | 0.008 | 0.007 | 0.751 | 0.070 | 0.0173 | 0.0007 | 0.45336 | 73 | 5 | 111 | 5 | 569 | 40 |
| 17 | DD12-11-8.1 | 2.0 | 0.024 | 0.004 | 0.242 | 0.019 | 0.0142 | 0.0004 | 0.32472 | 82 | 2 | 91 | 2 | 220 | 15 |
| 18 | DD12-11-9.1 | 1.3 | 0.015 | 0.010 | 0.216 | 0.021 | 0.0141 | 0.0004 | 0.31068 | 83 | 3 | 90 | 3 | 198 | 17 |
| 19 | DD12-11-9.2 | 1.3 | 0.015 | 0.002 | 0.210 | 0.021 | 0.0130 | 0.0004 | 0.31735 | 76 | 3 | 83 | 3 | 194 | 17 |
| 20 | DD12-11-10.1 | 1.4 | 0.018 | 0.004 | 0.311 | 0.025 | 0.0154 | 0.0004 | 0.34727 | 86 | 3 | 99 | 3 | 275 | 19 |
| 21 | DD12-11-11.1 | 1.1 | 0.012 | 0.005 | 0.360 | 0.029 | 0.0134 | 0.0004 | 0.38539 | 69 | 3 | 86 | 3 | 312 | 22 |
| 22 | DD12-11-12.1 | 2.0 | 0.018 | 0.001 | 0.186 | 0.015 | 0.0104 | 0.0003 | 0.32883 | 60 | 2 | 67 | 2 | 173 | 12 |
| 23 | DD12-11-13.1 | 1.2 | 0.026 | 0.005 | 1.508 | 0.075 | 0.0241 | 0.0006 | 0.50643 | 74 | 4 | 154 | 4 | 934 | 30 |
| 24 | DD12-11-14.1 | 3.2 | 0.030 | 0.032 | 0.180 | 0.013 | 0.0110 | 0.0002 | 0.31815 | 64 | 2 | 70 | 2 | 168 | 11 |
| 25 | DD12-11-15.1 | 1.1 | 0.014 | 0.003 | 0.341 | 0.034 | 0.0145 | 0.0005 | 0.36743 | 78 | 3 | 93 | 3 | 298 | 25 |
| 26 | DD12-11-16.1 | 1.9 | 0.021 | 0.001 | 0.197 | 0.015 | 0.0131 | 0.0003 | 0.30902 | 77 | 2 | 84 | 2 | 183 | 13 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | DD12-11-17.1 | 1.2 | 0.015 | 0.003 | 0.232 | 0.022 | 0.0140 | 0.0004 | 0.32085 | 81 | 3 | 90 | 3 | 212 | 18 |
| 28 | DD12-11-18.1 | 0.6 | 0.010 | 0.000 | 0.624 | 0.057 | 0.0179 | 0.0007 | 0.42306 | 85 | 4 | 115 | 4 | 492 | 35 |
| 29 | DD12-11-19.1 | 1.1 | 0.013 | 0.002 | 0.271 | 0.025 | 0.0138 | 0.0004 | 0.34354 | 77 | 3 | 88 | 3 | 244 | 20 |
| 30 | DD12-11-20.1 | 0.5 | 0.006 | 0.003 | 0.519 | 0.058 | 0.0149 | 0.0007 | 0.42114 | 71 | 5 | 96 | 4 | 425 | 38 |
| 31 | DD12-11-21.1 | 1.3 | 0.017 | 0.010 | 0.232 | 0.020 | 0.0151 | 0.0004 | 0.31230 | 89 | 3 | 96 | 3 | 212 | 16 |
| 32 | DD12-11-22.1 | 0.7 | 0.007 | 0.001 | 0.481 | 0.048 | 0.0118 | 0.0005 | 0.44150 | 51 | 3 | 75 | 3 | 399 | 32 |
| 33 | DD12-11-23.1 | 0.1 | 0.006 | 0.001 | 4.827 | 0.606 | 0.0634 | 0.0044 | 0.55495 | 144 | 31 | 396 | 27 | 1790 | 102 |
| 34 | DD12-11-24.1 | 0.7 | 0.009 | 0.006 | 0.607 | 0.056 | 0.0150 | 0.0006 | 0.44232 | 66 | 4 | 96 | 4 | 482 | 35 |
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 35 | DD12-11-12.1 | 1.5 | 1.120 | 0.521 | 96.466 | 0.635 | 0.8421 | 0.0043 | 0.78242 | -5 | 21 | 3938 | 15 | 4650 | 7 |
| 36 | DD12-11-14.4 | 0.2 | 0.003 | 0.001 | 0.996 | 0.082 | 0.0212 | 0.0007 | 0.41307 | 85 | 5 | 135 | 5 | 702 | 41 |
| 37 | DD12-11-16.1 | 0.2 | 0.010 | 0.014 | 3.985 | 0.153 | 0.0473 | 0.0009 | 0.51435 | 85 | 8 | 298 | 6 | 1631 | 31 |
| 38 | DD12-11-19.1 | 0.2 | 0.004 | 0.002 | 1.549 | 0.106 | 0.0281 | 0.0008 | 0.44105 | 99 | 6 | 178 | 5 | 950 | 41 |
| 39 | DD12-11-19.2 | 0.6 | 0.046 | 0.057 | 9.137 | 0.196 | 0.0965 | 0.0012 | 0.56504 | 113 | 10 | 594 | 7 | 2352 | 20 |
| 40 | DD12-11-19.3 | 0.2 | 0.005 | 0.082 | 1.417 | 0.088 | 0.0299 | 0.0008 | 0.42232 | 119 | 6 | 190 | 5 | 896 | 36 |
| 41 | DD12-11-20.1 | 0.2 | 0.008 | 0.038 | 2.906 | 0.163 | 0.0441 | 0.0012 | 0.47947 | 127 | 9 | 278 | 7 | 1384 | 42 |
| 42 | DD12-11-20.2 | 0.5 | 0.007 | 0.002 | 0.877 | 0.050 | 0.0178 | 0.0004 | 0.41985 | 69 | 3 | 114 | 3 | 640 | 27 |
| 43 | DD12-11-21.1 | 0.6 | 0.014 | 0.005 | 1.274 | 0.053 | 0.0260 | 0.0005 | 0.42583 | 101 | 3 | 166 | 3 | 834 | 23 |
| 44 | DD12-11-21.2 | 0.2 | 0.009 | 0.005 | 6.303 | 0.274 | 0.0665 | 0.0016 | 0.54550 | 78 | 14 | 415 | 10 | 2019 | 38 |
| 45 | DD12-11-22.1 | 0.3 | 0.009 | 0.016 | 3.146 | 0.134 | 0.0404 | 0.0009 | 0.50080 | 88 | 7 | 255 | 5 | 1444 | 32 |
| | ***DD12-12SE vein set*** | | | | | | | | | | | | | | |
| | **whole grain NIST-610** | | | | | | | | | | | | | | |
| 46 | DD12-12-1.1 | 1.3 | 0.020 | 0.004 | 0.753 | 0.065 | 0.0180 | 0.0007 | 0.44658 | 78 | 5 | 115 | 4 | 570 | 37 |
| 47 | DD12-12-2.1 | 4.8 | 0.063 | 0.002 | 0.214 | 0.016 | 0.0152 | 0.0003 | 0.30008 | 90 | 2 | 97 | 2 | 197 | 13 |
| 48 | DD12-12-3.1 | 1.9 | 0.024 | 0.003 | 0.157 | 0.022 | 0.0147 | 0.0005 | 0.26597 | 91 | 4 | 94 | 3 | 148 | 19 |
| 49 | DD12-12-4.1 | 3.9 | 0.046 | 0.001 | 0.143 | 0.013 | 0.0138 | 0.0003 | 0.26212 | 85 | 2 | 88 | 2 | 135 | 12 |
| 50 | DD12-12-5.1 | 1.5 | 0.048 | 0.004 | 3.955 | 0.184 | 0.0374 | 0.0010 | 0.57560 | 20 | 9 | 237 | 6 | 1625 | 37 |
| 51 | DD12-12-6.1 | 4.6 | 0.056 | 0.008 | 0.173 | 0.015 | 0.0139 | 0.0004 | 0.28365 | 84 | 2 | 89 | 2 | 162 | 13 |
| 52 | DD12-12-7.1 | 1.1 | 0.016 | 0.008 | 0.593 | 0.068 | 0.0171 | 0.0008 | 0.42036 | 81 | 5 | 109 | 5 | 473 | 43 |
| 53 | DD12-12-8.1 | 2.0 | 0.027 | 0.057 | 0.225 | 0.024 | 0.0151 | 0.0005 | 0.30630 | 89 | 3 | 97 | 3 | 206 | 20 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 | DD12-12-8.2 | 0.6 | 0.010 | 0.026 | 0.551 | 0.076 | 0.0176 | 0.0010 | 0.40659 | 87 | 6 | 112 | 6 | 446 | 49 |
| 55 | DD12-12-9.1 | 3.0 | 0.040 | 0.005 | 0.233 | 0.023 | 0.0154 | 0.0005 | 0.30879 | 90 | 3 | 98 | 3 | 213 | 19 |
| 56 | DD12-12-10.1 | 2.7 | 0.039 | 0.010 | 0.224 | 0.021 | 0.0164 | 0.0005 | 0.29628 | 98 | 3 | 105 | 3 | 205 | 17 |
| 57 | DD12-12-11.1 | 2.4 | 0.026 | 0.010 | 0.440 | 0.037 | 0.0128 | 0.0005 | 0.41675 | 61 | 3 | 82 | 3 | 370 | 26 |
| 58 | DD12-12-12.1 | 3.8 | 0.050 | 0.007 | 0.345 | 0.024 | 0.0152 | 0.0004 | 0.36149 | 83 | 3 | 97 | 2 | 301 | 18 |
| 59 | DD12-12-12.2 | 0.6 | 0.012 | 0.024 | 1.321 | 0.175 | 0.0247 | 0.0016 | 0.48397 | 89 | 11 | 157 | 10 | 855 | 74 |
| 60 | DD12-12-13.1 | 2.4 | 0.039 | 0.006 | 0.371 | 0.033 | 0.0183 | 0.0006 | 0.34844 | 102 | 4 | 117 | 4 | 321 | 24 |
| 61 | DD12-12-14.1 | 2.2 | 0.030 | 0.009 | 0.309 | 0.029 | 0.0155 | 0.0005 | 0.34471 | 87 | 3 | 99 | 3 | 274 | 22 |
| 62 | DD12-12-15.1 | 3.8 | 0.058 | 0.005 | 0.390 | 0.030 | 0.0175 | 0.0005 | 0.36032 | 96 | 3 | 112 | 3 | 335 | 21 |
| 63 | DD12-12-16.1 | 6.8 | 0.068 | 0.010 | 0.251 | 0.016 | 0.0116 | 0.0003 | 0.35368 | 64 | 2 | 74 | 2 | 227 | 13 |
| 64 | DD12-12-16.2 | 1.2 | 0.019 | 0.010 | 0.430 | 0.050 | 0.0175 | 0.0008 | 0.37312 | 94 | 5 | 112 | 5 | 363 | 35 |
| 65 | DD12-12-17.1 | 0.4 | 0.011 | 0.011 | 1.925 | 0.235 | 0.0296 | 0.0019 | 0.51279 | 87 | 13 | 188 | 12 | 1090 | 79 |
| 66 | DD12-12-19.1 | 4.7 | 0.054 | 0.008 | 0.202 | 0.017 | 0.0131 | 0.0003 | 0.31050 | 77 | 2 | 84 | 2 | 187 | 14 |
| 67 | DD12-12-20.1 | 6.3 | 0.096 | 0.009 | 0.343 | 0.021 | 0.0177 | 0.0004 | 0.34265 | 100 | 2 | 113 | 2 | 299 | 16 |
| 68 | DD12-12-21.1 | 1.7 | 0.021 | 0.009 | 0.223 | 0.028 | 0.0145 | 0.0006 | 0.31063 | 85 | 4 | 93 | 4 | 205 | 23 |
| 69 | DD12-12-22.1 | 1.0 | 0.015 | 0.001 | 0.383 | 0.048 | 0.0163 | 0.0008 | 0.36665 | 88 | 5 | 105 | 5 | 329 | 35 |
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 70 | DD12-12-3.1 | 1.2 | 0.011 | 0.007 | 0.193 | 0.012 | 0.0103 | 0.0002 | 0.28711 | 58 | 1 | 66 | 1 | 180 | 10 |
| 71 | DD12-12-4.1 | 0.6 | 0.008 | 0.002 | 0.346 | 0.023 | 0.0154 | 0.0003 | 0.31235 | 84 | 2 | 99 | 2 | 302 | 17 |
| 72 | DD12-12-5.1 | 0.2 | 0.007 | 0.031 | 2.691 | 0.129 | 0.0371 | 0.0009 | 0.48842 | 92 | 7 | 235 | 5 | 1326 | 35 |
| 73 | DD12-12-11.1 | 0.2 | 0.004 | 0.004 | 1.179 | 0.077 | 0.0232 | 0.0006 | 0.42738 | 88 | 5 | 148 | 4 | 791 | 35 |
| 74 | DD12-12-14.1 | 0.1 | 0.008 | 0.012 | 13.701 | 0.849 | 0.1294 | 0.0048 | 0.59985 | 66 | 40 | 785 | 27 | 2729 | 57 |
| 75 | DD12-12-14.2 | 0.2 | 0.009 | 0.009 | 6.403 | 0.289 | 0.0667 | 0.0016 | 0.54721 | 73 | 14 | 416 | 10 | 2033 | 39 |
| 76 | DD12-12-16.1 | 0.7 | 0.015 | 0.004 | 1.290 | 0.056 | 0.0252 | 0.0005 | 0.43039 | 95 | 3 | 161 | 3 | 841 | 25 |
| 77 | DD12-12-17.1 | 0.1 | 0.004 | 0.012 | 2.558 | 0.149 | 0.0358 | 0.0010 | 0.48400 | 91 | 8 | 227 | 6 | 1289 | 42 |
| 78 | DD12-12-17.2 | 1.5 | 0.082 | 0.013 | 5.580 | 0.086 | 0.0617 | 0.0005 | 0.53950 | 88 | 4 | 386 | 3 | 1913 | 13 |
| 79 | DD12-12-14.3 | 0.5 | 0.009 | 0.009 | 0.969 | 0.064 | 0.0232 | 0.0006 | 0.39916 | 100 | 4 | 148 | 4 | 688 | 33 |
| 80 | DD12-12-17.3clr | 1.0 | 0.018 | 0.003 | 0.552 | 0.038 | 0.0207 | 0.0005 | 0.33774 | 108 | 3 | 132 | 3 | 446 | 24 |
| 81 | DD12-12-17.4cdy | 0.3 | 0.023 | 0.040 | 9.031 | 0.550 | 0.0969 | 0.0033 | 0.56000 | 122 | 27 | 596 | 19 | 2341 | 55 |
| 82 | DD12-12-19.1cdy | 0.3 | 0.005 | 0.003 | 1.104 | 0.088 | 0.0241 | 0.0008 | 0.41212 | 98 | 6 | 153 | 5 | 755 | 42 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***DD12-12FV flat veins*** | | | | | | | | | | | | | | |
| | **whole grain NIST-610** | | | | | | | | | | | | | | |
| 83 | DD12-12FV-1b.1 | 2.8 | 0.021 | 0.019 | 0.384 | 0.027 | 0.0086 | 0.0003 | 0.53352 | 36 | 2 | 55 | 2 | 330 | 20 |
| 84 | DD12-12FV-1b.2 | 0.7 | 0.013 | 0.031 | 1.473 | 0.114 | 0.0201 | 0.0009 | 0.58763 | 49 | 6 | 128 | 6 | 919 | 46 |
| 85 | DD12-12FV-1b.3 | 2.0 | 0.023 | 0.045 | 0.272 | 0.022 | 0.0133 | 0.0005 | 0.43477 | 74 | 3 | 85 | 3 | 245 | 17 |
| 86 | DD12-12FV-2b.1 | 2.0 | 0.024 | 0.005 | 0.577 | 0.038 | 0.0142 | 0.0005 | 0.52352 | 62 | 3 | 91 | 3 | 463 | 24 |
| 87 | DD12-12FV-2b.2 | 1.2 | 0.018 | 0.008 | 1.004 | 0.066 | 0.0167 | 0.0006 | 0.56740 | 54 | 4 | 107 | 4 | 706 | 33 |
| 88 | DD12-12FV-3b.1 | 0.9 | 0.029 | 0.005 | 3.219 | 0.212 | 0.0370 | 0.0015 | 0.60646 | 60 | 10 | 234 | 9 | 1462 | 50 |
| 89 | DD12-12FV-3b.2 | 4.9 | 0.063 | 0.003 | 0.221 | 0.012 | 0.0148 | 0.0003 | 0.39255 | 87 | 2 | 94 | 2 | 203 | 10 |
| 90 | DD12-12FV-3b.3 | 0.6 | 0.013 | 0.007 | 1.976 | 0.168 | 0.0243 | 0.0012 | 0.59783 | 48 | 8 | 155 | 8 | 1107 | 56 |
| 91 | DD12-12FV-3b.4 | 1.1 | 0.014 | 0.006 | 0.660 | 0.057 | 0.0156 | 0.0007 | 0.52847 | 67 | 4 | 100 | 4 | 515 | 34 |
| 92 | DD12-12FV-3b.5 | 1.2 | 0.020 | 0.007 | 0.602 | 0.047 | 0.0195 | 0.0007 | 0.49013 | 97 | 4 | 125 | 5 | 479 | 30 |
| 93 | DD12-12FV-4b.1 | 0.6 | 0.015 | 0.032 | 2.179 | 0.162 | 0.0282 | 0.0012 | 0.59405 | 62 | 8 | 179 | 8 | 1175 | 51 |
| 94 | DD12-12FV-4b.2 | 1.6 | 0.028 | 0.016 | 1.102 | 0.065 | 0.0206 | 0.0007 | 0.55607 | 74 | 4 | 131 | 4 | 754 | 31 |
| 95 | DD12-12FV-4b.3 | 1.3 | 0.015 | 0.004 | 0.537 | 0.043 | 0.0133 | 0.0006 | 0.52241 | 58 | 3 | 85 | 4 | 436 | 28 |
| 96 | DD12-12FV-5b.1 | 0.4 | 0.010 | 0.024 | 1.423 | 0.131 | 0.0264 | 0.0014 | 0.55802 | 95 | 8 | 168 | 9 | 899 | 54 |
| 97 | DD12-12FV-5b.2 | 0.8 | 0.014 | 0.088 | 0.826 | 0.065 | 0.0199 | 0.0008 | 0.52689 | 86 | 5 | 127 | 5 | 611 | 36 |
| 98 | DD12-12FV-5b.3 | 0.5 | 0.009 | 0.022 | 0.875 | 0.084 | 0.0201 | 0.0010 | 0.53267 | 85 | 6 | 128 | 6 | 638 | 45 |
| 99 | DD12-12FV-7b.1 | 0.7 | 0.013 | 0.032 | 0.809 | 0.069 | 0.0196 | 0.0009 | 0.52633 | 85 | 5 | 125 | 6 | 602 | 38 |
| 100 | DD12-12FV-7b.2 | 0.5 | 0.008 | 0.042 | 1.222 | 0.121 | 0.0188 | 0.0011 | 0.57557 | 55 | 7 | 120 | 7 | 811 | 54 |
| 101 | DD12-12FV-1.1 | 1.0 | 0.017 | 0.001 | 0.664 | 0.084 | 0.0201 | 0.0011 | 0.41731 | 97 | 7 | 128 | 7 | 517 | 50 |
| 102 | DD12-12FV-2.1 | 0.4 | 0.005 | 0.005 | 0.386 | 0.078 | 0.0164 | 0.0012 | 0.36778 | 89 | 8 | 105 | 8 | 331 | 56 |
| 103 | DD12-12FV-2.2 | 0.8 | 0.012 | 0.003 | 0.835 | 0.087 | 0.0169 | 0.0008 | 0.47002 | 66 | 6 | 108 | 5 | 616 | 48 |
| 104 | DD12-12FV-3.1 | 0.6 | 0.010 | 0.003 | 0.798 | 0.092 | 0.0207 | 0.0011 | 0.43877 | 94 | 7 | 132 | 7 | 596 | 51 |
| 105 | DD12-12FV-4.1 | 0.7 | 0.016 | 0.002 | 1.208 | 0.114 | 0.0257 | 0.0011 | 0.46993 | 103 | 7 | 163 | 7 | 804 | 51 |
| 106 | DD12-12FV-4.2 | 1.8 | 0.033 | 0.001 | 0.690 | 0.052 | 0.0210 | 0.0007 | 0.41716 | 102 | 4 | 134 | 4 | 533 | 31 |
| 107 | DD12-12FV-5.1 | 1.0 | 0.021 | 0.001 | 1.072 | 0.113 | 0.0245 | 0.0012 | 0.45890 | 103 | 8 | 156 | 7 | 740 | 54 |
| 108 | DD12-12FV-6.1 | 2.1 | 0.029 | 0.002 | 0.252 | 0.021 | 0.0160 | 0.0004 | 0.31550 | 93 | 3 | 102 | 3 | 228 | 17 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109 | DD12-12FV-7.1 | 0.9 | 0.022 | 0.001 | 2.024 | 0.139 | 0.0295 | 0.0011 | 0.52202 | 81 | 8 | 188 | 7 | 1124 | 46 |
| 110 | DD12-12FV-8.1 | 0.4 | 0.008 | 0.002 | 1.027 | 0.133 | 0.0237 | 0.0014 | 0.45689 | 100 | 9 | 151 | 9 | 717 | 65 |
| 111 | DD12-12FV-9.1 | 0.9 | 0.014 | 0.000 | 0.620 | 0.067 | 0.0181 | 0.0008 | 0.42067 | 86 | 5 | 116 | 5 | 490 | 41 |
| 112 | DD12-12FV-10.1 | 0.5 | 0.012 | 0.005 | 1.665 | 0.159 | 0.0284 | 0.0014 | 0.50095 | 94 | 9 | 180 | 9 | 995 | 59 |
| 113 | DD12-12FV-10.2 | 3.5 | 0.108 | 0.001 | 2.672 | 0.080 | 0.0353 | 0.0006 | 0.53901 | 81 | 4 | 223 | 4 | 1321 | 22 |
| 114 | DD12-12FV-11.1 | 1.3 | 0.022 | 0.000 | 0.617 | 0.052 | 0.0194 | 0.0007 | 0.41111 | 95 | 4 | 124 | 4 | 488 | 32 |
| 115 | DD12-12FV-12.1 | 1.5 | 0.021 | 0.007 | 0.343 | 0.033 | 0.0161 | 0.0006 | 0.35473 | 89 | 4 | 103 | 4 | 300 | 25 |
| 116 | DD12-12FV-13.1 | 0.6 | 0.039 | 0.002 | 6.261 | 0.363 | 0.0704 | 0.0024 | 0.57974 | 106 | 18 | 438 | 14 | 2013 | 50 |
| 117 | DD12-12FV-14.1 | 0.6 | 0.021 | 0.000 | 3.016 | 0.228 | 0.0407 | 0.0017 | 0.53861 | 98 | 12 | 257 | 10 | 1412 | 56 |
| 118 | DD12-12FV-14.2 | 2.0 | 0.075 | 0.002 | 3.362 | 0.124 | 0.0430 | 0.0009 | 0.54730 | 92 | 6 | 271 | 5 | 1496 | 29 |
| 119 | DD12-12FV-15.1 | 5.2 | 0.073 | 0.001 | 0.423 | 0.043 | 0.0162 | 0.0006 | 0.38193 | 85 | 4 | 104 | 4 | 358 | 30 |
| 120 | DD12-12FV-16.1 | 8.7 | 0.095 | 0.002 | 0.129 | 0.009 | 0.0126 | 0.0002 | 0.26180 | 78 | 1 | 81 | 1 | 123 | 8 |
| 121 | DD12-12FV-17.1 | 0.4 | 0.011 | 0.002 | 1.351 | 0.170 | 0.0302 | 0.0018 | 0.46500 | 125 | 11 | 192 | 11 | 868 | 72 |
| 122 | DD12-12FV-18.1 | 0.6 | 0.016 | 0.000 | 2.201 | 0.215 | 0.0300 | 0.0016 | 0.52978 | 73 | 11 | 191 | 10 | 1181 | 66 |
| 123 | DD12-12FV-19.1 | 2.2 | 0.050 | 0.002 | 1.704 | 0.076 | 0.0267 | 0.0006 | 0.51069 | 80 | 4 | 170 | 4 | 1010 | 28 |
| 124 | DD12-12FV-20.1 | 2.0 | 0.021 | 0.001 | 0.201 | 0.024 | 0.0118 | 0.0005 | 0.32299 | 68 | 3 | 75 | 3 | 186 | 20 |
| 125 | DD12-12FV-21.1 | 6.9 | 0.041 | 0.000 | 0.110 | 0.011 | 0.0069 | 0.0002 | 0.31260 | 40 | 1 | 44 | 1 | 106 | 10 |
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 126 | DD12-12FV-1.1r | 0.1 | 0.003 | 0.003 | 1.895 | 0.208 | 0.0320 | 0.0016 | 0.45130 | 105 | 12 | 203 | 10 | 1079 | 71 |
| 127 | DD12-12FV-1.2 | 0.2 | 0.005 | 0.001 | 1.056 | 0.080 | 0.0232 | 0.0007 | 0.40887 | 95 | 5 | 148 | 5 | 732 | 39 |
| 128 | DD12-12FV-6.1clr | 0.0 | 0.002 | 0.000 | 5.065 | 2.720 | 0.0543 | 0.0154 | 0.52978 | 68 | 129 | 341 | 94 | 1830 | 392 |
| 129 | DD12-12FV-6.2cdy | 0.2 | 0.004 | 0.022 | 0.489 | 0.057 | 0.0190 | 0.0007 | 0.32875 | 100 | 5 | 121 | 5 | 404 | 38 |
| 130 | DD12-12FV-14.1clr | 0.1 | 0.006 | 0.008 | 8.531 | 0.695 | 0.0962 | 0.0043 | 0.55166 | 147 | 35 | 592 | 25 | 2289 | 72 |
| 131 | DD12-12FV-14.2cdy | 0.7 | 0.012 | 0.006 | 0.502 | 0.033 | 0.0192 | 0.0004 | 0.33237 | 101 | 3 | 123 | 3 | 413 | 22 |
| 132 | DD12-12FV-15.1r | 0.0 | 0.005 | 0.003 | 17.666 | 1.397 | 0.1694 | 0.0082 | 0.61427 | 102 | 65 | 1009 | 45 | 2972 | 74 |
| 133 | DD12-12FV-15.2 | 0.2 | 0.021 | 0.010 | 12.194 | 0.473 | 0.1170 | 0.0027 | 0.58659 | 71 | 23 | 713 | 15 | 2619 | 36 |
| 134 | DD12-12FV-22.1 | 0.4 | 0.011 | 0.016 | 2.161 | 0.148 | 0.0323 | 0.0010 | 0.47176 | 91 | 8 | 205 | 7 | 1169 | 47 |
| 135 | DD12-12FV-19.1clr | 0.1 | 0.004 | 0.010 | 6.648 | 0.560 | 0.0752 | 0.0034 | 0.53826 | 116 | 28 | 467 | 20 | 2066 | 72 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th$ / $^{238}U$ | $^{207}Pb$ / $^{235}U$ | 1 Sig | $^{206}Pb$ / $^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb$ / $^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb$ / $^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb$ / $^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 136 | DD12-12FV-1.1 | 0.1 | 0.002 | 0.001 | 2.594 | 0.293 | 0.0357 | 0.0020 | 0.48713 | 89 | 16 | 226 | 12 | 1299 | 80 |
| 137 | DD12-12FV-1.2 | 0.1 | 0.002 | 0.001 | 1.973 | 0.183 | 0.0276 | 0.0012 | 0.47780 | 71 | 10 | 176 | 8 | 1106 | 61 |
| 138 | DD12-12FV-6.1 | 0.2 | 0.003 | 0.000 | 0.718 | 0.060 | 0.0185 | 0.0006 | 0.38579 | 83 | 4 | 118 | 4 | 549 | 35 |
| 139 | DD12-12FV-6.2 | 0.2 | 0.005 | 0.001 | 1.394 | 0.082 | 0.0260 | 0.0007 | 0.43648 | 94 | 5 | 166 | 4 | 886 | 34 |
| 140 | DD12-12FV-10.1 | 0.1 | 0.006 | 0.019 | 14.721 | 0.783 | 0.1381 | 0.0045 | 0.60643 | 64 | 37 | 834 | 25 | 2797 | 50 |
| 141 | DD12-12FV-10.2 | 0.6 | 0.004 | 0.001 | 0.299 | 0.021 | 0.0082 | 0.0002 | 0.36853 | 38 | 2 | 53 | 1 | 265 | 17 |
| 142 | DD12-12FV-14.1 | 0.1 | 0.004 | 0.004 | 8.308 | 0.541 | 0.0817 | 0.0030 | 0.56449 | 62 | 27 | 506 | 18 | 2265 | 58 |
| 143 | DD12-12FV-14.2 | 0.2 | 0.006 | 0.004 | 1.679 | 0.102 | 0.0306 | 0.0008 | 0.44300 | 108 | 6 | 194 | 5 | 1000 | 38 |
| 144 | DD12-12FV-14.3 | 0.5 | 0.025 | 0.007 | 6.286 | 0.136 | 0.0625 | 0.0007 | 0.55199 | 52 | 7 | 391 | 5 | 2016 | 19 |
| 145 | DD12-12FV-15.1 | 0.1 | 0.006 | 0.002 | 7.383 | 0.397 | 0.0774 | 0.0023 | 0.55350 | 88 | 20 | 481 | 14 | 2159 | 47 |
| | ***DD12-13N vein set*** | | | | | | | | | | | | | | |
| | **whole grain NIST-610** | | | | | | | | | | | | | | |
| 146 | DD12-13-1.1 | 0.5 | 0.011 | 0.001 | 1.885 | 0.123 | 0.0268 | 0.0009 | 0.51920 | 70 | 7 | 170 | 6 | 1076 | 43 |
| 147 | DD12-13-1.2 | 0.4 | 0.008 | 0.000 | 1.484 | 0.138 | 0.0208 | 0.0010 | 0.51705 | 53 | 7 | 133 | 6 | 924 | 55 |
| 148 | DD12-13-2.1 | 1.4 | 0.017 | 0.001 | 0.220 | 0.020 | 0.0140 | 0.0004 | 0.31138 | 82 | 3 | 89 | 2 | 202 | 16 |
| 149 | DD12-13-2.2 | 0.3 | 0.005 | 0.006 | 0.892 | 0.113 | 0.0180 | 0.0011 | 0.46783 | 70 | 7 | 115 | 7 | 647 | 59 |
| 150 | DD12-13-3.1 | 3.0 | 0.019 | 0.001 | 0.122 | 0.013 | 0.0071 | 0.0002 | 0.31857 | 41 | 2 | 46 | 2 | 117 | 12 |
| 151 | DD12-13-3.2 | 0.6 | 0.007 | 0.000 | 0.296 | 0.039 | 0.0150 | 0.0007 | 0.34118 | 84 | 4 | 96 | 4 | 263 | 30 |
| 152 | DD12-13-4.1 | 0.9 | 0.011 | 0.009 | 0.216 | 0.024 | 0.0144 | 0.0005 | 0.30589 | 85 | 3 | 92 | 3 | 199 | 20 |
| 153 | DD12-13-4.2 | 1.3 | 0.015 | 0.001 | 0.383 | 0.032 | 0.0132 | 0.0004 | 0.39308 | 67 | 3 | 84 | 3 | 329 | 23 |
| 154 | DD12-13-5.1 | 0.3 | 0.005 | 0.000 | 2.248 | 0.250 | 0.0230 | 0.0014 | 0.55707 | 23 | 12 | 146 | 9 | 1196 | 76 |
| 155 | DD12-13-5.2 | 0.2 | 0.006 | 0.001 | 2.049 | 0.207 | 0.0313 | 0.0016 | 0.51392 | 91 | 11 | 199 | 10 | 1132 | 67 |
| 156 | DD12-13-6.1 | 0.6 | 0.006 | 0.001 | 0.254 | 0.034 | 0.0120 | 0.0006 | 0.35057 | 66 | 4 | 77 | 4 | 230 | 27 |
| 157 | DD12-13-6.2 | 0.1 | 0.003 | 0.002 | 1.032 | 0.191 | 0.0246 | 0.0020 | 0.45109 | 105 | 13 | 156 | 13 | 720 | 92 |
| 158 | DD12-13-7.1 | 1.9 | 0.012 | 0.000 | 0.145 | 0.016 | 0.0071 | 0.0003 | 0.34271 | 40 | 2 | 46 | 2 | 137 | 14 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 159 | DD12-13-8.2 | 0.7 | 0.009 | 0.001 | 0.290 | 0.035 | 0.0154 | 0.0006 | 0.33753 | 87 | 4 | 98 | 4 | 259 | 27 |
| 160 | DD12-13-9.1 | 0.6 | 0.007 | 0.003 | 0.328 | 0.041 | 0.0148 | 0.0007 | 0.35901 | 81 | 4 | 94 | 4 | 288 | 31 |
| 161 | DD12-13-9.2 | 0.5 | 0.007 | 0.000 | 0.520 | 0.054 | 0.0174 | 0.0007 | 0.40085 | 87 | 5 | 111 | 5 | 425 | 36 |
| 162 | DD12-13-10.1 | 0.4 | 0.006 | 0.001 | 0.526 | 0.067 | 0.0157 | 0.0008 | 0.41583 | 76 | 5 | 101 | 5 | 429 | 44 |
| 163 | DD12-13-12.1 | 0.3 | 0.005 | 0.000 | 1.838 | 0.199 | 0.0236 | 0.0014 | 0.53220 | 51 | 10 | 150 | 9 | 1059 | 69 |
| 164 | DD12-13-12.2 | 0.2 | 0.004 | 0.003 | 1.129 | 0.138 | 0.0230 | 0.0013 | 0.47307 | 89 | 9 | 146 | 8 | 767 | 64 |
| 165 | DD12-13-1Ab.1 | 1.7 | 0.018 | 0.001 | 0.128 | 0.012 | 0.0120 | 0.0003 | 0.26723 | 74 | 2 | 77 | 2 | 122 | 11 |
| 166 | DD12-13-1Bb.1 | 0.6 | 0.011 | 0.080 | 0.864 | 0.089 | 0.0207 | 0.0011 | 0.52725 | 89 | 7 | 132 | 7 | 632 | 48 |
| 167 | DD12-13-2b.1 | 0.6 | 0.015 | 0.002 | 2.231 | 0.212 | 0.0273 | 0.0016 | 0.59829 | 53 | 11 | 174 | 10 | 1191 | 65 |
| 168 | DD12-13-4b.1 | 1.5 | 0.023 | 0.001 | 0.526 | 0.047 | 0.0176 | 0.0008 | 0.48496 | 88 | 4 | 112 | 5 | 429 | 31 |
| 169 | DD12-13-4b.2 | 1.1 | 0.015 | 0.000 | 0.479 | 0.046 | 0.0170 | 0.0008 | 0.47726 | 87 | 5 | 109 | 5 | 398 | 31 |
| 170 | DD12-13-5b.1 | 0.9 | 0.013 | 0.003 | 0.384 | 0.043 | 0.0163 | 0.0008 | 0.45355 | 88 | 5 | 104 | 5 | 330 | 31 |
| 171 | DD12-13-5b.2 | 1.1 | 0.016 | 0.005 | 0.648 | 0.057 | 0.0171 | 0.0008 | 0.51487 | 78 | 5 | 109 | 5 | 507 | 34 |
| 172 | DD12-13-5b.3 | 1.4 | 0.014 | 0.001 | 0.627 | 0.054 | 0.0117 | 0.0006 | 0.55328 | 43 | 3 | 75 | 4 | 494 | 33 |
| 173 | DD12-13-5b.4 | 1.8 | 0.017 | 0.001 | 1.088 | 0.140 | 0.0111 | 0.0009 | 0.61042 | 11 | 7 | 71 | 6 | 748 | 66 |
| 174 | DD12-13-3b.1 | 0.6 | 0.013 | 0.039 | 0.878 | 0.087 | 0.0266 | 0.0013 | 0.49939 | 128 | 8 | 169 | 8 | 640 | 46 |
| 175 | DD12-13-3b.2 | 2.6 | 0.035 | 0.004 | 0.453 | 0.029 | 0.0156 | 0.0005 | 0.48083 | 79 | 3 | 100 | 3 | 379 | 20 |
| 176 | DD12-13-6b.1 | 1.6 | 0.022 | 0.001 | 0.559 | 0.043 | 0.0156 | 0.0006 | 0.50743 | 73 | 4 | 100 | 4 | 451 | 28 |
| 177 | DD12-13-6b.2 | 0.1 | 0.004 | 0.003 | 2.111 | 0.349 | 0.0309 | 0.0030 | 0.58251 | 85 | 19 | 196 | 19 | 1152 | 109 |
| 178 | DD12-13-6b.3 | 2.4 | 0.033 | 0.010 | 0.490 | 0.036 | 0.0160 | 0.0006 | 0.48754 | 80 | 3 | 103 | 4 | 405 | 24 |
| 179 | DD12-13-6b.4 | 2.8 | 0.043 | 0.002 | 0.709 | 0.035 | 0.0180 | 0.0005 | 0.51993 | 80 | 3 | 115 | 3 | 544 | 21 |
| 180 | DD12-13-6b.5 | 2.4 | 0.025 | 0.004 | 0.571 | 0.038 | 0.0121 | 0.0004 | 0.53941 | 49 | 3 | 78 | 3 | 459 | 24 |
| 181 | DD12-13-7b.1 | 0.8 | 0.011 | 0.004 | 0.468 | 0.053 | 0.0165 | 0.0009 | 0.47760 | 85 | 5 | 106 | 6 | 390 | 36 |
| 182 | DD12-13-8b.1 | 3.8 | 0.026 | 0.001 | 0.215 | 0.016 | 0.0080 | 0.0003 | 0.46934 | 42 | 2 | 51 | 2 | 198 | 14 |
| 183 | DD12-13-9b.1 | 2.9 | 0.037 | 0.000 | 0.226 | 0.016 | 0.0149 | 0.0004 | 0.39308 | 88 | 3 | 96 | 3 | 207 | 13 |
| 184 | DD12-13-10b.1 | 0.3 | 0.009 | 0.001 | 1.667 | 0.199 | 0.0312 | 0.0021 | 0.55717 | 113 | 12 | 198 | 13 | 996 | 74 |
| 185 | DD12-13-11b.1 | 1.4 | 0.017 | 0.000 | 0.440 | 0.039 | 0.0143 | 0.0006 | 0.48811 | 71 | 4 | 92 | 4 | 370 | 27 |
| 186 | DD12-13-11b.2 | 0.4 | 0.007 | 0.002 | 1.116 | 0.130 | 0.0191 | 0.0013 | 0.56452 | 63 | 8 | 122 | 8 | 761 | 61 |
| 187 | DD12-13-12b.1 | 0.2 | 0.004 | 0.003 | 2.478 | 0.476 | 0.0279 | 0.0032 | 0.60565 | 42 | 23 | 177 | 20 | 1266 | 133 |
| 188 | DD12-13-Vein.1 | 3.6 | 0.114 | 0.013 | 1.149 | 0.079 | 0.0367 | 0.0013 | 0.49483 | 180 | 7 | 233 | 8 | 777 | 37 |
| 189 | DD12-13-Host.1 | 2.6 | 0.187 | 0.024 | 4.754 | 0.186 | 0.0829 | 0.0019 | 0.57558 | 278 | 11 | 513 | 11 | 1777 | 32 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th$ / $^{238}U$ | $^{207}Pb$ / $^{235}U$ | 1 Sig | $^{206}Pb$ / $^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb$ / $^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb$ / $^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb$ / $^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | DD12-13-5b.5 | 2.4 | 0.025 | 0.002 | 0.326 | 0.028 | 0.0118 | 0.0005 | 0.47394 | 61 | 3 | 76 | 3 | 287 | 21 |
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 191 | DD12-13-1.1r | 0.02 | 0.047 | 0.178 | 397.821 | 34.170 | 3.4068 | 0.2708 | 0.92558 | -407 | 664 | 9561 | 385 | 6081 | 84 |
| 192 | DD12-13-1.2 | 0.02 | 0.002 | 0.002 | 12.141 | 1.705 | 0.1126 | 0.0093 | 0.58653 | 44 | 77 | 688 | 54 | 2615 | 126 |
| 193 | DD12-13-7.1r | 0.03 | 0.089 | 0.024 | 464.731 | 21.860 | 3.9380 | 0.1732 | 0.93524 | -721 | 398 | 10295 | 222 | 6238 | 47 |
| 194 | DD12-13-7.2 | 0.10 | 0.004 | 0.001 | 3.944 | 0.353 | 0.0438 | 0.0020 | 0.51993 | 63 | 18 | 276 | 13 | 1623 | 71 |
| 195 | DD12-13-2.1r | 0.03 | 0.002 | 0.003 | 5.236 | 0.638 | 0.0568 | 0.0037 | 0.53256 | 75 | 32 | 356 | 22 | 1859 | 100 |
| 196 | DD12-13-2.2 | 0.14 | 0.026 | 0.344 | 24.091 | 0.779 | 0.2156 | 0.0045 | 0.64620 | 35 | 35 | 1259 | 24 | 3272 | 31 |
| 197 | DD12-13-3.1r | 0.11 | 0.003 | 0.001 | 1.772 | 0.188 | 0.0263 | 0.0013 | 0.46634 | 74 | 11 | 167 | 8 | 1035 | 67 |
| 198 | DD12-13-3.2 | 0.09 | 0.002 | 0.002 | 1.829 | 0.203 | 0.0282 | 0.0014 | 0.46211 | 83 | 11 | 179 | 9 | 1056 | 71 |
| 199 | DD12-13-4.1r | 0.22 | 0.006 | 0.007 | 1.880 | 0.131 | 0.0295 | 0.0010 | 0.46022 | 89 | 7 | 188 | 6 | 1074 | 46 |
| 200 | DD12-13-4.2 | 0.22 | 0.007 | 0.003 | 3.191 | 0.202 | 0.0364 | 0.0012 | 0.50867 | 58 | 10 | 231 | 7 | 1455 | 48 |
| 201 | DD12-13-8.1r | 0.08 | 0.002 | 0.001 | 1.983 | 0.250 | 0.0295 | 0.0017 | 0.46720 | 82 | 14 | 187 | 11 | 1110 | 82 |
| 202 | DD12-13-8.2 | 0.12 | 0.004 | 0.002 | 3.541 | 0.270 | 0.0391 | 0.0015 | 0.51486 | 55 | 14 | 247 | 10 | 1536 | 59 |
| 203 | DD12-13-9.1r | 0.06 | 0.004 | 0.001 | 7.369 | 0.657 | 0.0822 | 0.0040 | 0.54323 | 121 | 33 | 509 | 24 | 2157 | 77 |
| 204 | DD12-13-9.2 | 0.09 | 0.006 | 0.007 | 7.666 | 0.457 | 0.0786 | 0.0026 | 0.55214 | 79 | 23 | 488 | 15 | 2193 | 52 |
| | **Polished NIST612** | | | | | | | | | | | | | | |
| 205 | DD12-13-3.1clr | 0.27 | 0.004 | 0.001 | 0.520 | 0.038 | 0.0183 | 0.0005 | 0.34462 | 94 | 3 | 117 | 3 | 425 | 25 |
| 206 | DD12-13-3.2cld | 0.19 | 0.003 | 0.001 | 1.422 | 0.090 | 0.0199 | 0.0006 | 0.47273 | 51 | 5 | 127 | 4 | 898 | 37 |
| 207 | DD12-13-4.1r | 0.07 | 0.022 | 0.000 | 41.337 | 1.649 | 0.3659 | 0.0105 | 0.71964 | 32 | 63 | 2010 | 49 | 3803 | 39 |
| 208 | DD12-13-4.2c | 0.46 | 0.029 | 0.125 | 8.146 | 0.375 | 0.0725 | 0.0019 | 0.57600 | 9 | 17 | 451 | 12 | 2247 | 41 |
| 209 | DD12-13-4.3r | 0.10 | 0.004 | 0.001 | 3.658 | 0.236 | 0.0464 | 0.0015 | 0.50904 | 98 | 12 | 292 | 9 | 1562 | 50 |
| 210 | DD12-13-4.4c | 0.04 | 0.002 | 0.000 | 5.536 | 0.464 | 0.0582 | 0.0026 | 0.54343 | 66 | 23 | 364 | 16 | 1906 | 70 |
| 211 | DD12-13-8.1 | 0.03 | 0.001 | 0.004 | 4.526 | 0.532 | 0.0501 | 0.0031 | 0.53021 | 72 | 27 | 315 | 19 | 1736 | 94 |
| 212 | DD12-13-8.2 | 0.19 | 0.003 | 0.006 | 0.939 | 0.077 | 0.0192 | 0.0007 | 0.42109 | 75 | 5 | 123 | 4 | 672 | 40 |
| 213 | DD12-13-5.1 | 0.05 | 0.005 | 0.000 | 11.527 | 0.610 | 0.1132 | 0.0035 | 0.59050 | 85 | 29 | 691 | 20 | 2567 | 49 |
| 214 | DD12-13-5.2 | 0.01 | 0.017 | 0.000 | 199.234 | 33.442 | 1.6749 | 0.2488 | 0.88495 | -388 | 392 | 6343 | 573 | 5381 | 159 |
| 215 | DD12-13-11.1 | 0.46 | 0.009 | 0.001 | 1.501 | 0.101 | 0.0217 | 0.0007 | 0.46989 | 59 | 6 | 139 | 4 | 931 | 40 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th$ / $^{238}U$ | $^{207}Pb$ / $^{235}U$ | 1 Sig | $^{206}Pb$ / $^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb$ / $^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb$ / $^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb$ / $^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***DGR-3-034.61 Drill core*** | | | | | | | | | | | | | | |
| | **whole grain NIST-612** | | | | | | | | | | | | | | |
| 216 | DGR34B-1c | 0.89 | 0.008 | 0.020 | 0.588 | 0.055 | 0.0102 | 0.0004 | 0.44006 | 35 | 3 | 66 | 3 | 469 | 35 |
| 217 | DGR34B-2 | 0.12 | 0.004 | 0.061 | 2.785 | 0.362 | 0.0372 | 0.0024 | 0.48672 | 87 | 20 | 235 | 15 | 1352 | 94 |
| 218 | DGR34B-3 | 0.34 | 0.009 | 0.022 | 1.414 | 0.132 | 0.0296 | 0.0012 | 0.42670 | 117 | 8 | 188 | 7 | 895 | 54 |
| 219 | DGR34B-4 | 0.47 | 0.032 | 0.028 | 8.675 | 0.573 | 0.0802 | 0.0030 | 0.56079 | 30 | 28 | 497 | 18 | 2304 | 59 |
| 220 | DGR34B-5 | 0.13 | 0.004 | 0.096 | 3.429 | 0.417 | 0.0345 | 0.0022 | 0.52074 | 31 | 21 | 219 | 14 | 1511 | 92 |
| 221 | DGR34B-6 | 0.33 | 0.008 | 0.017 | 1.390 | 0.133 | 0.0277 | 0.0011 | 0.43014 | 106 | 8 | 176 | 7 | 885 | 55 |
| 222 | DGR34B-7s | 0.38 | 0.008 | 0.021 | 1.207 | 0.124 | 0.0254 | 0.0011 | 0.42317 | 101 | 8 | 161 | 7 | 804 | 56 |
| 223 | DGR34B-8s | 0.13 | 0.002 | 0.017 | 0.420 | 0.065 | 0.0183 | 0.0009 | 0.31547 | 99 | 6 | 117 | 6 | 356 | 46 |
| 224 | DGR34B-9s | 0.07 | 0.001 | 0.039 | 0.670 | 0.114 | 0.0228 | 0.0014 | 0.34851 | 115 | 9 | 146 | 9 | 521 | 67 |
| 225 | DGR34B-10s | 0.14 | 0.002 | 0.014 | 0.637 | 0.077 | 0.0163 | 0.0008 | 0.38456 | 73 | 5 | 104 | 5 | 500 | 47 |
| 226 | DGR34B-11 | 0.10 | 0.002 | 0.010 | 1.528 | 0.160 | 0.0269 | 0.0013 | 0.44331 | 92 | 10 | 171 | 8 | 942 | 63 |
| 227 | DGR34B-12t | 0.12 | 0.002 | 0.021 | 0.511 | 0.070 | 0.0191 | 0.0009 | 0.33583 | 99 | 6 | 122 | 6 | 419 | 46 |
| 228 | DGR34B-13c | 0.04 | 0.001 | 0.003 | 1.292 | 0.210 | 0.0249 | 0.0017 | 0.42842 | 93 | 13 | 159 | 11 | 842 | 90 |
| 229 | DGR34B-14s | 0.11 | 0.002 | 0.021 | 1.230 | 0.143 | 0.0255 | 0.0012 | 0.42065 | 100 | 9 | 163 | 8 | 815 | 63 |
| 230 | DGR34B-15r | 0.15 | 0.003 | 0.011 | 0.777 | 0.100 | 0.0223 | 0.0011 | 0.37359 | 105 | 7 | 142 | 7 | 584 | 56 |
| 231 | DGR34B-16s | 0.14 | 0.002 | 0.015 | 0.295 | 0.052 | 0.0171 | 0.0009 | 0.28104 | 99 | 6 | 110 | 5 | 262 | 40 |
| 232 | DGR34B-17st | 0.11 | 0.002 | 0.015 | 0.768 | 0.098 | 0.0211 | 0.0010 | 0.37987 | 98 | 7 | 135 | 6 | 579 | 55 |
| 233 | DGR34B-18r | 0.10 | 0.002 | 0.017 | 0.990 | 0.131 | 0.0238 | 0.0013 | 0.39864 | 103 | 9 | 152 | 8 | 699 | 65 |
| 234 | DGR34B-19s | 0.14 | 0.004 | 0.010 | 1.383 | 0.125 | 0.0317 | 0.0012 | 0.41421 | 133 | 8 | 201 | 7 | 882 | 52 |
| 235 | DGR34B-20c | 0.06 | 0.002 | 0.064 | 2.066 | 0.268 | 0.0405 | 0.0023 | 0.43741 | 152 | 17 | 256 | 14 | 1138 | 86 |
| 236 | DGR34B-21s | 0.04 | 0.001 | 0.029 | 0.772 | 0.163 | 0.0230 | 0.0018 | 0.36925 | 110 | 12 | 147 | 11 | 581 | 90 |
| 237 | DGR34B-22s | 0.03 | 0.001 | 0.031 | 1.904 | 0.366 | 0.0246 | 0.0023 | 0.48524 | 54 | 20 | 156 | 14 | 1083 | 122 |
| 238 | DGR34B-23s | 0.10 | 0.002 | 0.010 | 0.594 | 0.095 | 0.0191 | 0.0011 | 0.35928 | 94 | 7 | 122 | 7 | 473 | 59 |
| 239 | DGR34B-24r | 0.17 | 0.003 | 0.017 | 0.446 | 0.068 | 0.0194 | 0.0009 | 0.31895 | 105 | 6 | 124 | 6 | 375 | 47 |
| 240 | DGR34B-25s | 0.05 | 0.002 | 0.126 | 2.963 | 0.446 | 0.0392 | 0.0029 | 0.48901 | 90 | 24 | 248 | 18 | 1398 | 110 |
| 241 | DGR34B-26r | 0.09 | 0.003 | 0.013 | 1.787 | 0.192 | 0.0336 | 0.0016 | 0.43909 | 122 | 12 | 213 | 10 | 1041 | 68 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 242 | DGR34B-27st | 0.11 | 0.002 | 0.015 | 0.760 | 0.100 | 0.0244 | 0.0012 | 0.36077 | 120 | 8 | 155 | 7 | 574 | 56 |
| 243 | DGR-3-1.1 | 0.93 | 0.009 | 0.01 | 0.561 | 0.035 | 0.0110 | 0.0003 | 0.41864 | 42 | 2 | 71 | 2 | 452 | 23 |
| 244 | DGR-3-1.2 | 0.23 | 0.004 | 0.03 | 0.549 | 0.053 | 0.0193 | 0.0006 | 0.34620 | 99 | 4 | 124 | 4 | 444 | 34 |
| 245 | DGR-3-1.3 | 0.98 | 0.006 | 0.01 | 0.163 | 0.020 | 0.0073 | 0.0003 | 0.30692 | 40 | 2 | 47 | 2 | 153 | 17 |
| 246 | DGR-3-2.1 | 1.04 | 0.008 | 0.01 | 0.419 | 0.025 | 0.0088 | 0.0002 | 0.40970 | 35 | 2 | 56 | 1 | 356 | 18 |
| 247 | DGR-3-3.1 | 0.42 | 0.007 | 0.02 | 0.334 | 0.033 | 0.0189 | 0.0005 | 0.28584 | 108 | 4 | 121 | 3 | 293 | 25 |
| 248 | DGR-3-3.2 | 0.28 | 0.006 | 0.03 | 1.125 | 0.111 | 0.0254 | 0.0010 | 0.41205 | 105 | 7 | 162 | 6 | 765 | 52 |
| 249 | DGR-3-3.3 | 0.25 | 0.004 | 0.02 | 0.419 | 0.045 | 0.0205 | 0.0007 | 0.30346 | 115 | 5 | 131 | 4 | 356 | 32 |
| 250 | DGR-3-4.1 | 0.30 | 0.015 | 0.02 | 4.149 | 0.174 | 0.0592 | 0.0013 | 0.50260 | 156 | 9 | 371 | 8 | 1664 | 34 |
| 251 | DGR-3-4.2 | 10.53 | 2.237 | 0.02 | 19.046 | 0.161 | 0.2456 | 0.0013 | 0.62652 | 526 | 8 | 1416 | 7 | 3044 | 8 |
| 252 | DGR-3-5.1 | 0.38 | 0.003 | 0.03 | 0.270 | 0.028 | 0.0095 | 0.0003 | 0.33784 | 49 | 2 | 61 | 2 | 242 | 22 |
| 253 | DGR-3-6.1 | 2.33 | 0.013 | 0.02 | 0.058 | 0.005 | 0.0063 | 0.0001 | 0.20625 | 40 | 1 | 41 | 1 | 57 | 5 |
| 254 | DGR-3-6.2 | 2.15 | 0.018 | 0.01 | 0.482 | 0.024 | 0.0098 | 0.0002 | 0.41335 | 38 | 2 | 63 | 1 | 400 | 17 |
| 255 | DGR-3-7.1 br lmst | 2.12 | 0.227 | 0.01 | 4.579 | 0.061 | 0.1234 | 0.0008 | 0.45683 | 554 | 5 | 750 | 4 | 1745 | 11 |
| 256 | DGR-3-8.1 bk lmst | 10.51 | 10.424 | 0.01 | 85.216 | 0.251 | 1.1457 | 0.0026 | 0.76901 | 0 | 0 | 4922 | 8 | 4525 | 3 |
| 257 | DGR-3-9.1 bk lmst | 3.63 | 2.209 | 0.01 | 51.655 | 0.265 | 0.7039 | 0.0027 | 0.73695 | 0 | 0 | 3436 | 10 | 4025 | 5 |
| 258 | DGR-3-9.2 br lmst | 2.71 | 0.329 | 0.01 | 4.000 | 0.061 | 0.1402 | 0.0009 | 0.42415 | 695 | 5 | 846 | 5 | 1634 | 12 |
| 259 | DGR-3-9.3 bk lmst | 13.67 | 17.630 | 0.00 | 116.061 | 0.337 | 1.4896 | 0.0034 | 0.78857 | 0 | 0 | 5880 | 9 | 4836 | 3 |
| 260 | DGR-3-9.4 br lmst | 1.91 | 0.660 | 0.01 | 27.583 | 0.364 | 0.3984 | 0.0035 | 0.66177 | 1027 | 17 | 2162 | 16 | 3404 | 13 |
| 261 | DGR-3-1B.1 | 0.09 | 0.002 | 0.01 | 2.215 | 0.224 | 0.0304 | 0.0015 | 0.48539 | 75 | 12 | 193 | 9 | 1186 | 69 |
| 262 | DGR-3-1B.2 | 0.10 | 0.002 | 0.03 | 0.998 | 0.125 | 0.0217 | 0.0011 | 0.41359 | 88 | 8 | 138 | 7 | 703 | 62 |
| 263 | DGR-3-1B.3 | 0.12 | 0.002 | 0.03 | 1.633 | 0.167 | 0.0237 | 0.0011 | 0.47138 | 64 | 9 | 151 | 7 | 983 | 63 |
| 264 | DGR-3-2B.1 | 0.10 | 0.006 | 0.01 | 5.806 | 0.449 | 0.0619 | 0.0026 | 0.54691 | 76 | 22 | 387 | 16 | 1947 | 65 |
| 265 | DGR-3-3B.1 | 0.06 | 0.001 | 0.03 | 1.507 | 0.250 | 0.0223 | 0.0017 | 0.46757 | 62 | 14 | 142 | 11 | 933 | 97 |
| | **Vug** | | | | | | | | | | | | | | |
| 266 | DGR-3-034.1 | 0.48 | 0.048 | 0.07 | 8.880 | 0.261 | 0.1010 | 0.0017 | 0.56193 | 158 | 13 | 620 | 10 | 2326 | 27 |
| 267 | DGR-3-034.2 | 0.24 | 0.015 | 0.13 | 6.263 | 0.306 | 0.0609 | 0.0016 | 0.55378 | 42 | 15 | 381 | 10 | 2013 | 42 |
| 268 | DGR-3-034.3 | 0.70 | 0.047 | 0.05 | 5.266 | 0.189 | 0.0669 | 0.0013 | 0.52313 | 141 | 10 | 417 | 8 | 1863 | 30 |
| 269 | DGR-3-034.4 | 0.25 | 0.005 | 0.10 | 0.954 | 0.098 | 0.0199 | 0.0009 | 0.41619 | 79 | 6 | 127 | 5 | 680 | 50 |
| 270 | DGR-3-034.5 | 0.33 | 0.006 | 0.05 | 0.991 | 0.103 | 0.0184 | 0.0008 | 0.43142 | 66 | 6 | 117 | 5 | 699 | 52 |
| 271 | DGR-3-034.6 | 0.47 | 0.021 | 0.03 | 4.408 | 0.228 | 0.0458 | 0.0013 | 0.53412 | 50 | 12 | 289 | 8 | 1714 | 42 |

| | Spot | U (ppm) | Pb206 (ppm) | $^{232}$Th/$^{238}$U | $^{207}$Pb/$^{235}$U | 1 Sig | $^{206}$Pb/$^{238}$U | 1 Sig | Error Correl. | $^{206}$Pb/$^{238}$U Model Age (Ma) | 1 Sig | $^{206}$Pb/$^{238}$U Age (Ma) | 1 Sig | $^{207}$Pb/$^{235}$U Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 272 | DGR-3-034.7 | 0.45 | 0.012 | 0.01 | 1.847 | 0.138 | 0.0261 | 0.0009 | 0.47580 | 68 | 8 | 166 | 6 | 1062 | 48 |
| 273 | DGR-3-034.8 | 1.10 | 0.039 | 0.01 | 3.030 | 0.139 | 0.0352 | 0.0008 | 0.51004 | 59 | 7 | 223 | 5 | 1415 | 35 |
| 274 | DGR-3-034.9 | 2.21 | 0.586 | 0.01 | 17.208 | 0.388 | 0.2658 | 0.0036 | 0.60597 | 760 | 20 | 1519 | 18 | 2946 | 21 |
| 275 | DGR-3-034.10 | 0.72 | 0.019 | 0.00 | 1.571 | 0.104 | 0.0271 | 0.0008 | 0.44816 | 91 | 6 | 172 | 5 | 959 | 41 |
| 276 | DGR-3-034.11 | 0.38 | 0.020 | 0.07 | 5.819 | 0.498 | 0.0537 | 0.0025 | 0.55400 | 19 | 24 | 337 | 16 | 1949 | 72 |
| 277 | DGR-3-034.12 | 1.97 | 0.295 | 0.01 | 6.055 | 0.167 | 0.1502 | 0.0020 | 0.47907 | 644 | 12 | 902 | 11 | 1984 | 24 |
| | **Natural surface NIST610** | | | | | | | | | | | | | | |
| 278 | DGR34A-1.1 | 0.17 | 0.005 | 0.03 | 2.546 | 0.119 | 0.0374 | 0.0008 | 0.48316 | 103 | 7 | 237 | 5 | 1285 | 34 |
| 279 | DGR34A-3.1 | 0.43 | 0.006 | 0.01 | 0.553 | 0.035 | 0.0171 | 0.0004 | 0.36140 | 84 | 3 | 109 | 2 | 447 | 23 |
| 280 | DGR34A-4.1 | 0.31 | 0.008 | 0.09 | 1.964 | 0.136 | 0.0317 | 0.0010 | 0.46555 | 99 | 8 | 201 | 6 | 1103 | 46 |
| 281 | DGR34A-5.1 | 1.33 | 0.020 | 0.01 | 0.267 | 0.015 | 0.0177 | 0.0003 | 0.26663 | 105 | 2 | 113 | 2 | 240 | 12 |
| 282 | DGR34A-6.1 | 0.31 | 0.005 | 0.01 | 0.545 | 0.039 | 0.0190 | 0.0005 | 0.34694 | 97 | 3 | 122 | 3 | 442 | 25 |
| 283 | DGR34A-6.2 | 0.95 | 0.015 | 0.01 | 0.239 | 0.013 | 0.0179 | 0.0003 | 0.25420 | 107 | 2 | 114 | 2 | 218 | 11 |
| 284 | DGR34A-7.1 | 0.27 | 0.004 | 0.01 | 0.552 | 0.041 | 0.0165 | 0.0005 | 0.36583 | 79 | 3 | 105 | 3 | 446 | 27 |
| 285 | DGR34A-8.1 | 2.22 | 0.034 | 0.01 | 0.215 | 0.010 | 0.0178 | 0.0002 | 0.24348 | 108 | 1 | 114 | 1 | 197 | 8 |
| 286 | DGR34A-9.1 | 2.72 | 0.039 | 0.01 | 0.219 | 0.008 | 0.0167 | 0.0002 | 0.25514 | 100 | 1 | 106 | 1 | 201 | 7 |
| 287 | DGR34A-10.1 | 0.59 | 0.010 | 0.01 | 0.532 | 0.031 | 0.0187 | 0.0004 | 0.34595 | 96 | 3 | 120 | 2 | 433 | 20 |
| 288 | DGR34A-11.1 | 0.55 | 0.008 | 0.01 | 0.379 | 0.026 | 0.0169 | 0.0004 | 0.31301 | 92 | 2 | 108 | 2 | 326 | 19 |
| 289 | DGR34A-12.1 | 0.57 | 0.009 | 0.01 | 0.521 | 0.042 | 0.0173 | 0.0005 | 0.35087 | 87 | 3 | 111 | 3 | 426 | 28 |
| 290 | DGR34A-13.1 | 0.36 | 0.007 | 0.03 | 0.885 | 0.048 | 0.0223 | 0.0005 | 0.39352 | 99 | 3 | 142 | 3 | 644 | 26 |
| 291 | DGR34A-14.1 | 1.59 | 0.024 | 0.01 | 0.351 | 0.015 | 0.0176 | 0.0002 | 0.29950 | 99 | 2 | 113 | 1 | 305 | 11 |
| 292 | DGR34A-15.1 | 0.22 | 0.003 | 0.03 | 0.355 | 0.033 | 0.0167 | 0.0005 | 0.30464 | 93 | 3 | 107 | 3 | 308 | 25 |
| 293 | DGR34A-16.1 | 1.01 | 0.014 | 0.01 | 0.177 | 0.010 | 0.0160 | 0.0002 | 0.23173 | 98 | 1 | 102 | 1 | 165 | 8 |
| | **Crystal base NIST610** | | | | | | | | | | | | | | |
| 294 | DGR34A-1.1b | 0.48 | 0.006 | 0.05 | 0.349 | 0.020 | 0.0150 | 0.0003 | 0.31545 | 82 | 2 | 96 | 2 | 304 | 15 |
| 295 | DGR34A-2.1b | 1.10 | 0.016 | 0.06 | 0.390 | 0.018 | 0.0163 | 0.0002 | 0.32036 | 88 | 2 | 104 | 2 | 334 | 13 |
| 296 | DGR34A-3.1b | 0.29 | 0.005 | 0.02 | 0.668 | 0.034 | 0.0205 | 0.0004 | 0.36425 | 100 | 3 | 131 | 2 | 520 | 21 |
| 297 | DGR34A-4.1b | 0.47 | 0.009 | 0.03 | 0.810 | 0.046 | 0.0226 | 0.0005 | 0.37886 | 106 | 3 | 144 | 3 | 602 | 25 |
| 298 | DGR34A-6.1b | 0.40 | 0.007 | 0.03 | 0.407 | 0.025 | 0.0202 | 0.0004 | 0.30120 | 113 | 3 | 129 | 2 | 346 | 18 |
| 299 | DGR34A-6.2b | 0.28 | 0.005 | 0.04 | 0.665 | 0.041 | 0.0226 | 0.0005 | 0.35279 | 114 | 3 | 144 | 3 | 518 | 25 |
| 300 | DGR34A-7.1b | 0.73 | 0.012 | 0.02 | 0.280 | 0.016 | 0.0182 | 0.0003 | 0.26894 | 107 | 2 | 117 | 2 | 251 | 12 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 301 | DGR34A-8.1b | 0.36 | 0.007 | 0.06 | 0.662 | 0.040 | 0.0214 | 0.0005 | 0.35883 | 106 | 3 | 136 | 3 | 516 | 24 |
| 302 | DGR34A-9.1b | 0.30 | 0.007 | 0.06 | 1.156 | 0.059 | 0.0253 | 0.0005 | 0.41658 | 103 | 4 | 161 | 3 | 780 | 28 |
| 303 | DGR34A-10.1b | 0.16 | 0.005 | 0.13 | 1.568 | 0.102 | 0.0345 | 0.0009 | 0.42225 | 141 | 7 | 219 | 6 | 958 | 40 |
| 304 | DGR34A-11.1b | 0.49 | 0.009 | 0.05 | 0.682 | 0.038 | 0.0212 | 0.0004 | 0.36299 | 104 | 3 | 136 | 3 | 528 | 22 |
| 305 | DGR34A-12.1b | 0.54 | 0.009 | 0.01 | 0.486 | 0.025 | 0.0191 | 0.0003 | 0.33045 | 101 | 2 | 122 | 2 | 402 | 17 |
| 306 | DGR34A-13.1b | 0.61 | 0.011 | 0.01 | 0.520 | 0.024 | 0.0203 | 0.0003 | 0.33251 | 107 | 2 | 129 | 2 | 425 | 16 |
| 307 | DGR34A-14.1b | 0.17 | 0.005 | 0.10 | 1.551 | 0.098 | 0.0322 | 0.0009 | 0.42726 | 127 | 6 | 205 | 5 | 951 | 38 |
| 308 | DGR34A-15.1b | 0.56 | 0.007 | 0.00 | 0.294 | 0.018 | 0.0150 | 0.0003 | 0.29416 | 84 | 2 | 96 | 2 | 262 | 14 |
| 309 | DGR34A-16.1b | 0.51 | 0.009 | 0.02 | 0.551 | 0.029 | 0.0198 | 0.0004 | 0.34293 | 102 | 2 | 126 | 2 | 445 | 19 |
| | **Natural surface NIST610** | | | | | | | | | | | | | | |
| 310 | DGR34B-1c | 0.89 | 0.009 | 0.02 | 0.588 | 0.055 | 0.0102 | 0.0004 | 0.44006 | 35 | 3 | 66 | 3 | 469 | 35 |
| 311 | DGR34B-2 | 0.12 | 0.005 | 0.06 | 2.785 | 0.362 | 0.0372 | 0.0024 | 0.48672 | 87 | 20 | 235 | 15 | 1352 | 94 |
| 312 | DGR34B-3 | 0.34 | 0.010 | 0.02 | 1.414 | 0.132 | 0.0296 | 0.0012 | 0.42670 | 117 | 8 | 188 | 7 | 895 | 54 |
| 313 | DGR34B-4 | 0.47 | 0.037 | 0.03 | 8.675 | 0.573 | 0.0802 | 0.0030 | 0.56079 | 30 | 28 | 497 | 18 | 2304 | 59 |
| 314 | DGR34B-5 | 0.13 | 0.005 | 0.10 | 3.429 | 0.417 | 0.0345 | 0.0022 | 0.52074 | 31 | 21 | 219 | 14 | 1511 | 92 |
| 315 | DGR34B-6 | 0.33 | 0.009 | 0.02 | 1.390 | 0.133 | 0.0277 | 0.0011 | 0.43014 | 106 | 8 | 176 | 7 | 885 | 55 |
| 316 | DGR34B-7s | 0.38 | 0.010 | 0.02 | 1.207 | 0.124 | 0.0254 | 0.0011 | 0.42317 | 101 | 8 | 161 | 7 | 804 | 56 |
| 317 | DGR34B-8s | 0.13 | 0.002 | 0.017 | 0.420 | 0.065 | 0.0183 | 0.0009 | 0.31547 | 99 | 6 | 117 | 6 | 356 | 46 |
| 318 | DGR34B-9s | 0.07 | 0.002 | 0.039 | 0.670 | 0.114 | 0.0228 | 0.0014 | 0.34851 | 115 | 9 | 146 | 9 | 521 | 67 |
| 319 | DGR34B-10s | 0.14 | 0.002 | 0.014 | 0.637 | 0.077 | 0.0163 | 0.0008 | 0.38456 | 73 | 5 | 104 | 5 | 500 | 47 |
| 320 | DGR34B-11 | 0.10 | 0.003 | 0.01 | 1.528 | 0.160 | 0.0269 | 0.0013 | 0.44331 | 92 | 10 | 171 | 8 | 942 | 63 |
| 321 | DGR34B-12t | 0.12 | 0.002 | 0.021 | 0.511 | 0.070 | 0.0191 | 0.0009 | 0.33583 | 99 | 6 | 122 | 6 | 419 | 46 |
| 322 | DGR34B-13c | 0.04 | 0.001 | 0.003 | 1.292 | 0.210 | 0.0249 | 0.0017 | 0.42842 | 93 | 13 | 159 | 11 | 842 | 90 |
| 323 | DGR34B-14s | 0.11 | 0.003 | 0.021 | 1.230 | 0.143 | 0.0255 | 0.0012 | 0.42065 | 100 | 9 | 163 | 8 | 815 | 63 |
| 324 | DGR34B-15r | 0.15 | 0.003 | 0.011 | 0.777 | 0.100 | 0.0223 | 0.0011 | 0.37359 | 105 | 7 | 142 | 7 | 584 | 56 |
| 325 | DGR34B-16s | 0.14 | 0.002 | 0.015 | 0.295 | 0.052 | 0.0171 | 0.0009 | 0.28104 | 99 | 6 | 110 | 5 | 262 | 40 |
| 326 | DGR34B-17st | 0.11 | 0.002 | 0.015 | 0.768 | 0.098 | 0.0211 | 0.0010 | 0.37987 | 98 | 7 | 135 | 6 | 579 | 55 |
| 327 | DGR34B-18r | 0.10 | 0.002 | 0.017 | 0.990 | 0.131 | 0.0238 | 0.0013 | 0.39864 | 103 | 9 | 152 | 8 | 699 | 65 |
| 328 | DGR34B-19s | 0.14 | 0.004 | 0.01 | 1.383 | 0.125 | 0.0317 | 0.0012 | 0.41421 | 133 | 8 | 201 | 7 | 882 | 52 |
| 329 | DGR34B-20c | 0.06 | 0.002 | 0.064 | 2.066 | 0.268 | 0.0405 | 0.0023 | 0.43741 | 152 | 17 | 256 | 14 | 1138 | 86 |
| 330 | DGR34B-21s | 0.04 | 0.001 | 0.029 | 0.772 | 0.163 | 0.0230 | 0.0018 | 0.36925 | 110 | 12 | 147 | 11 | 581 | 90 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | $^{232}Th/^{238}U$ | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | $^{206}Pb/^{238}U$ Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 331 | DGR34B-22s | 0.03 | 0.001 | 0.031 | 1.904 | 0.366 | 0.0246 | 0.0023 | 0.48524 | 54 | 20 | 156 | 14 | 1083 | 122 |
| 332 | DGR34B-23s | 0.10 | 0.002 | 0.01 | 0.594 | 0.095 | 0.0191 | 0.0011 | 0.35928 | 94 | 7 | 122 | 7 | 473 | 59 |
| 333 | DGR34B-24r | 0.17 | 0.003 | 0.017 | 0.446 | 0.068 | 0.0194 | 0.0009 | 0.31895 | 105 | 6 | 124 | 6 | 375 | 47 |
| 334 | DGR34B-25s | 0.05 | 0.002 | 0.126 | 2.963 | 0.446 | 0.0392 | 0.0029 | 0.48901 | 90 | 24 | 248 | 18 | 1398 | 110 |
| 335 | DGR34B-26r | 0.09 | 0.003 | 0.013 | 1.787 | 0.192 | 0.0336 | 0.0016 | 0.43909 | 122 | 12 | 213 | 10 | 1041 | 68 |
| 336 | DGR34B-27st | 0.11 | 0.003 | 0.015 | 0.760 | 0.100 | 0.0244 | 0.0012 | 0.36077 | 120 | 8 | 155 | 7 | 574 | 56 |
| | **Crystal base NIST610** | | | | | | | | | | | | | | |
| 337 | DGR34B-1b | 0.76 | 0.008 | 0.02 | 0.802 | 0.064 | 0.0123 | 0.0004 | 0.45264 | 36 | 4 | 79 | 3 | 598 | 36 |
| 338 | DGR34B-2b | 0.33 | 0.004 | 0.15 | 0.741 | 0.074 | 0.0157 | 0.0006 | 0.41051 | 63 | 5 | 100 | 4 | 563 | 42 |
| 339 | DGR34B-3b | 0.40 | 0.008 | 0.04 | 1.180 | 0.104 | 0.0234 | 0.0009 | 0.42563 | 89 | 6 | 149 | 6 | 791 | 47 |
| 340 | DGR34B-4b | 0.36 | 0.013 | 0.07 | 2.806 | 0.206 | 0.0418 | 0.0015 | 0.47857 | 118 | 11 | 264 | 9 | 1357 | 54 |
| 341 | DGR34B-5b | 0.52 | 0.008 | 0.07 | 1.308 | 0.105 | 0.0179 | 0.0007 | 0.47294 | 44 | 6 | 114 | 4 | 849 | 45 |
| 342 | DGR34B-6b | 0.62 | 0.009 | 0.05 | 0.537 | 0.051 | 0.0158 | 0.0006 | 0.36623 | 76 | 4 | 101 | 4 | 436 | 33 |
| 343 | DGR34B-7b | 0.31 | 0.006 | 0.08 | 1.015 | 0.103 | 0.0215 | 0.0009 | 0.41560 | 86 | 7 | 137 | 6 | 711 | 51 |
| 344 | DGR34B-8b | 0.34 | 0.006 | 0.06 | 0.851 | 0.094 | 0.0204 | 0.0009 | 0.39748 | 88 | 6 | 130 | 6 | 625 | 50 |
| 345 | DGR34B-9b | 0.38 | 0.009 | 0.03 | 1.587 | 0.134 | 0.0286 | 0.0011 | 0.44365 | 100 | 8 | 182 | 7 | 965 | 51 |
| 346 | DGR34B-10b | 0.31 | 0.009 | 0.13 | 2.117 | 0.192 | 0.0331 | 0.0014 | 0.46675 | 99 | 11 | 210 | 9 | 1154 | 61 |
| 347 | DGR34B-11b | 0.51 | 0.008 | 0.09 | 0.522 | 0.039 | 0.0180 | 0.0005 | 0.34719 | 91 | 3 | 115 | 3 | 427 | 26 |
| 348 | DGR34B-12b | 0.42 | 0.008 | 0.05 | 0.898 | 0.061 | 0.0221 | 0.0006 | 0.39537 | 97 | 4 | 141 | 4 | 651 | 32 |
| 349 | DGR34B-13b | 0.22 | 0.007 | 0.19 | 2.279 | 0.172 | 0.0374 | 0.0013 | 0.46178 | 119 | 10 | 237 | 8 | 1206 | 52 |
| 350 | DGR34B-14b | 0.19 | 0.006 | 0.09 | 2.887 | 0.211 | 0.0388 | 0.0014 | 0.49012 | 92 | 11 | 245 | 9 | 1378 | 54 |
| 351 | DGR34B-15b | 0.53 | 0.011 | 0.04 | 1.432 | 0.077 | 0.0244 | 0.0006 | 0.44781 | 81 | 5 | 156 | 4 | 903 | 32 |
| 352 | DGR34B-16b | 0.57 | 0.010 | 0.04 | 0.606 | 0.041 | 0.0194 | 0.0005 | 0.35801 | 96 | 3 | 124 | 3 | 481 | 26 |
| 353 | DGR34B-17b | 0.54 | 0.008 | 0.02 | 0.541 | 0.039 | 0.0179 | 0.0005 | 0.35255 | 89 | 3 | 114 | 3 | 439 | 25 |
| 354 | DGR34B-18b | 3.23 | 0.015 | 0.02 | 0.199 | 0.012 | 0.0055 | 0.0001 | 0.36978 | 25 | 1 | 35 | 1 | 184 | 10 |
| 355 | DGR34B-19b | 0.27 | 0.033 | 0.01 | 14.133 | 0.832 | 0.1406 | 0.0049 | 0.58967 | 116 | 40 | 848 | 28 | 2759 | 55 |
| 356 | DGR34B-20b | 0.44 | 0.008 | 0.02 | 1.025 | 0.060 | 0.0214 | 0.0005 | 0.41818 | 85 | 4 | 136 | 3 | 716 | 30 |
| 357 | DGR34B-21b | 0.46 | 0.009 | 0.03 | 0.663 | 0.046 | 0.0217 | 0.0005 | 0.35628 | 108 | 4 | 138 | 3 | 516 | 28 |
| 358 | DGR34B-22b | 2.37 | 0.016 | 0.03 | 0.154 | 0.010 | 0.0076 | 0.0002 | 0.29579 | 43 | 1 | 49 | 1 | 145 | 9 |
| 359 | DGR34B-23b | 1.58 | 0.019 | 0.06 | 0.219 | 0.014 | 0.0136 | 0.0002 | 0.27276 | 80 | 2 | 87 | 2 | 201 | 12 |
| 360 | DGR34B-24b | 0.45 | 0.008 | 0.04 | 0.979 | 0.065 | 0.0206 | 0.0006 | 0.41614 | 82 | 4 | 132 | 4 | 693 | 33 |

| | Spot | U (ppm) | Pb206 (ppm) | 232Th / 238U | 207Pb / 235U | 1 Sig | 206Pb / 238U | 1 Sig | Error Correl. | 206Pb / 238U Model Age (Ma) | 1 Sig | 206Pb / 238U Age (Ma) | 1 Sig | 207Pb / 235U Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 361 | DGR34B-25b | 0.21 | 0.006 | 0.21 | 2.613 | 0.177 | 0.0318 | 0.0011 | 0.49903 | 61 | 9 | 202 | 7 | 1304 | 49 |
| 362 | DGR34B-26b | 0.48 | 0.011 | 0.05 | 1.756 | 0.095 | 0.0263 | 0.0007 | 0.46797 | 74 | 5 | 167 | 4 | 1029 | 35 |
| 363 | DGR34B-27b | 0.64 | 0.009 | 0.05 | 0.734 | 0.047 | 0.0157 | 0.0004 | 0.41166 | 63 | 3 | 100 | 3 | 559 | 27 |
| | **natural surface NIST610** | | | | | | | | | | | | | | |
| 364 | DGR34C-1r | 0.28 | 0.005 | 0.08 | 0.686 | 0.063 | 0.0221 | 0.0007 | 0.35994 | 109 | 5 | 141 | 5 | 531 | 37 |
| 365 | DGR34C-2 | 0.94 | 0.016 | 0.00 | 0.699 | 0.046 | 0.0191 | 0.0005 | 0.38086 | 89 | 3 | 122 | 3 | 538 | 27 |
| 366 | DGR34C-3 | 1.48 | 0.017 | 0.00 | 0.287 | 0.018 | 0.0134 | 0.0003 | 0.30946 | 74 | 2 | 86 | 2 | 256 | 14 |
| 367 | DGR34C-4r | 0.66 | 0.019 | 0.00 | 2.009 | 0.148 | 0.0333 | 0.0011 | 0.46087 | 107 | 9 | 211 | 7 | 1119 | 49 |
| 368 | DGR34C-5s | 0.36 | 0.009 | 0.06 | 1.814 | 0.117 | 0.0305 | 0.0009 | 0.45639 | 99 | 7 | 193 | 6 | 1050 | 42 |
| 369 | DGR34C-6As | 0.41 | 0.009 | 0.03 | 1.091 | 0.090 | 0.0250 | 0.0008 | 0.40867 | 105 | 6 | 159 | 5 | 749 | 43 |
| 370 | DGR34C-6Bs | 0.74 | 0.011 | 0.01 | 0.577 | 0.039 | 0.0173 | 0.0004 | 0.36697 | 83 | 3 | 110 | 3 | 462 | 25 |
| 371 | DGR34C-7s | 0.45 | 0.009 | 0.11 | 1.129 | 0.081 | 0.0227 | 0.0007 | 0.42498 | 87 | 5 | 145 | 4 | 767 | 38 |
| 372 | DGR34C-9s | 0.86 | 0.011 | 0.05 | 0.937 | 0.061 | 0.0151 | 0.0004 | 0.45047 | 47 | 3 | 97 | 3 | 671 | 31 |
| 373 | DGR34C-10 | 7.98 | 0.050 | 0.01 | 0.140 | 0.007 | 0.0072 | 0.0001 | 0.29529 | 41 | 1 | 46 | 1 | 133 | 6 |
| 374 | DGR34C-11r | 0.50 | 0.008 | 0.01 | 0.561 | 0.044 | 0.0189 | 0.0005 | 0.35148 | 95 | 4 | 121 | 3 | 452 | 28 |
| 375 | DGR34C-13 | 0.42 | 0.007 | 0.06 | 0.701 | 0.060 | 0.0198 | 0.0006 | 0.37576 | 93 | 4 | 127 | 4 | 539 | 35 |
| 376 | DGR34C-14s | 0.93 | 0.014 | 0.00 | 0.500 | 0.032 | 0.0179 | 0.0004 | 0.34367 | 92 | 3 | 115 | 2 | 412 | 21 |
| 377 | DGR34C-15t | 0.87 | 0.017 | 0.01 | 1.194 | 0.076 | 0.0228 | 0.0006 | 0.43330 | 84 | 5 | 146 | 4 | 798 | 35 |
| 378 | DGR34C-16.1s | 0.89 | 0.012 | 0.00 | 0.339 | 0.027 | 0.0157 | 0.0004 | 0.30981 | 86 | 3 | 100 | 2 | 296 | 20 |
| 379 | DGR34C-16.2r | 0.61 | 0.010 | 0.04 | 0.735 | 0.069 | 0.0185 | 0.0007 | 0.39067 | 82 | 5 | 118 | 4 | 560 | 40 |
| 380 | DGR34C-17c | 0.73 | 0.007 | 0.07 | 0.549 | 0.046 | 0.0111 | 0.0004 | 0.41612 | 43 | 3 | 71 | 2 | 444 | 30 |
| 381 | DGR34C-18s | 0.57 | 0.009 | 0.02 | 0.811 | 0.058 | 0.0194 | 0.0006 | 0.39856 | 84 | 4 | 124 | 3 | 603 | 32 |
| 382 | DGR34C-19c | 1.55 | 0.030 | 0.02 | 1.153 | 0.040 | 0.0223 | 0.0003 | 0.43296 | 83 | 2 | 142 | 2 | 778 | 19 |
| 383 | DGR34C-20c | 0.29 | 0.008 | 0.04 | 1.963 | 0.126 | 0.0303 | 0.0009 | 0.46691 | 90 | 7 | 193 | 6 | 1103 | 43 |
| | **crystal base NIST610** | | | | | | | | | | | | | | |
| 384 | DGR34C-1b | 0.27 | 0.008 | 0.13 | 2.693 | 0.218 | 0.0356 | 0.0014 | 0.48761 | 82 | 12 | 226 | 9 | 1327 | 59 |
| 385 | DGR34C-2b | 0.53 | 0.023 | 0.05 | 2.944 | 0.156 | 0.0502 | 0.0012 | 0.46323 | 166 | 9 | 316 | 8 | 1393 | 39 |
| 386 | DGR34C-3b | 0.76 | 0.008 | 0.04 | 0.522 | 0.047 | 0.0123 | 0.0004 | 0.39515 | 52 | 3 | 79 | 3 | 427 | 31 |
| 387 | DGR34C-4b | 0.37 | 0.009 | 0.01 | 1.529 | 0.126 | 0.0276 | 0.0010 | 0.44200 | 97 | 8 | 175 | 6 | 942 | 49 |
| 388 | DGR34C-5b | 0.70 | 0.011 | 0.00 | 0.786 | 0.062 | 0.0178 | 0.0006 | 0.40380 | 74 | 4 | 114 | 4 | 589 | 35 |

| | Spot | U (ppm) | Pb$^{206}$ (ppm) | $^{232}$Th/$^{238}$U | $^{207}$Pb/$^{235}$U | 1 Sig | $^{206}$Pb/$^{238}$U | 1 Sig | Error Correl. | $^{206}$Pb/$^{238}$U Model Age (Ma) | 1 Sig | $^{206}$Pb/$^{238}$U Age (Ma) | 1 Sig | $^{207}$Pb/$^{235}$U Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 389 | DGR34C-6Ab | 0.28 | 0.008 | 0.11 | 2.420 | 0.212 | 0.0335 | 0.0014 | 0.48153 | 84 | 12 | 212 | 9 | 1249 | 61 |
| 390 | DGR34C-7b | 0.27 | 0.008 | 0.13 | 2.410 | 0.225 | 0.0325 | 0.0015 | 0.48404 | 78 | 12 | 206 | 9 | 1245 | 65 |
| 391 | DGR34C-8b | 0.22 | 0.006 | 0.08 | 2.336 | 0.228 | 0.0319 | 0.0015 | 0.48202 | 78 | 12 | 203 | 9 | 1223 | 67 |
| 392 | DGR34C-9b | 0.42 | 0.006 | 0.06 | 1.040 | 0.114 | 0.0177 | 0.0009 | 0.44249 | 59 | 7 | 113 | 5 | 724 | 55 |
| 393 | DGR34C-10b | 0.39 | 0.008 | 0.03 | 1.339 | 0.130 | 0.0253 | 0.0011 | 0.43386 | 92 | 8 | 161 | 7 | 863 | 55 |
| 394 | DGR34C-11b | 0.40 | 0.007 | 0.05 | 0.835 | 0.100 | 0.0202 | 0.0010 | 0.39578 | 88 | 7 | 129 | 6 | 616 | 54 |
| 395 | DGR34C-13b | 0.36 | 0.007 | 0.05 | 1.071 | 0.135 | 0.0235 | 0.0012 | 0.41115 | 96 | 9 | 150 | 8 | 739 | 65 |
| 396 | DGR34C-14b | 0.27 | 0.007 | 0.11 | 2.604 | 0.252 | 0.0309 | 0.0015 | 0.50023 | 55 | 13 | 196 | 9 | 1302 | 69 |
| 397 | DGR34C-15b | 0.18 | 0.006 | 0.18 | 2.719 | 0.320 | 0.0403 | 0.0023 | 0.47645 | 112 | 18 | 255 | 14 | 1334 | 85 |
| 398 | DGR34C-16.1b | 0.33 | 0.006 | 0.05 | 0.575 | 0.049 | 0.0197 | 0.0006 | 0.34946 | 99 | 4 | 126 | 4 | 461 | 31 |
| 399 | DGR34C-16.2b | 0.45 | 0.007 | 0.02 | 0.645 | 0.051 | 0.0190 | 0.0006 | 0.36878 | 91 | 4 | 122 | 4 | 505 | 31 |
| 400 | DGR34C-17b | 0.33 | 0.009 | 0.19 | 1.592 | 0.119 | 0.0307 | 0.0010 | 0.43579 | 114 | 7 | 195 | 6 | 967 | 46 |
| 401 | DGR34C-18b | 0.45 | 0.009 | 0.03 | 1.188 | 0.078 | 0.0229 | 0.0006 | 0.43076 | 85 | 5 | 146 | 4 | 795 | 36 |
| 402 | DGR34C-19b | 0.42 | 0.034 | 0.09 | 9.591 | 0.335 | 0.0936 | 0.0019 | 0.56892 | 66 | 16 | 577 | 11 | 2396 | 32 |
| 403 | DGR34C-20b | 0.30 | 0.006 | 0.04 | 1.203 | 0.079 | 0.0233 | 0.0007 | 0.43063 | 87 | 5 | 149 | 4 | 802 | 36 |
| | ***DGR-6-886.91B Drill core*** | | | | | | | | | | | | | | |
| | **whole grain NIST-612** | | | | | | | | | | | | | | |
| 404 | DGR-6-3.2 | 0.11 | 0.008 | 0.22 | 1.231 | 0.137 | 0.0834 | 0.0028 | 0.29713 | 484 | 17 | 516 | 16 | 815 | 61 |
| 405 | DGR-6-3.3 | 0.14 | 0.011 | 0.16 | 2.634 | 0.259 | 0.0912 | 0.0035 | 0.39344 | 455 | 22 | 563 | 21 | 1310 | 70 |
| 406 | DGR-6-3.4 | 0.07 | 0.009 | 0.19 | 9.445 | 0.723 | 0.1491 | 0.0062 | 0.54328 | 444 | 39 | 896 | 35 | 2382 | 68 |
| 407 | DGR-6-3.4 br lmst | 0.16 | 0.300 | 1.02 | 243.402 | 4.413 | 2.1956 | 0.0357 | 0.89769 | 458 | 112 | 7489 | 72 | 5583 | 18 |
| 408 | DGR-5-2.3 bk lmst | 0.63 | 0.307 | 0.53 | 54.894 | 0.608 | 0.5675 | 0.0047 | 0.74287 | 583 | 23 | 2898 | 19 | 4085 | 11 |
| 409 | DGR-6-1.1 | 0.07 | 0.016 | 0.19 | 24.274 | 1.264 | 0.2700 | 0.0091 | 0.64826 | 388 | 57 | 1541 | 46 | 3279 | 50 |
| 410 | DGR-6-1.2 | 0.26 | 0.442 | 0.36 | 224.046 | 2.975 | 1.9967 | 0.0235 | 0.88776 | 262 | 80 | 7075 | 50 | 5500 | 13 |

**FOOTNOTES TO APPENDIX A1**

All analyses carried out using the 213 nm laser.

FV- flat vein; b - base of grain cluster, other spots on crystal faces; br - brownish, black - black, lmst - limestone, cdy - cloudy, clr - clear

Error Correl. - Error correlation coefficient for concordia coordinates

Relation between ages and concordia coordinates: Y = 206Pb/238U = EXP(L238*(206-238Age)) - 1;
X = 207Pb/235U = EXP(L235*(207-235Age)) - 1; 207Pb/206Pb = 137.88*X/Y; U decay constants (L238 & L235) from Jaffey et al. (1971).

## APPENDIX A2: SUMMARY OF NEW LA-ICPMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***DGR-3-37.37*** | ***Devonian Lucas Fm*** | | | | | | | | | | | | | |
| | ***May11-15a M150510*** | ***213nm*** | | | | | | | | | | | | | |
| 1 | DGR-3-37.37-gr1.1 | 0.99 | 0.012 | 0.00 | 0.185 | 0.008 | 0.0125 | 0.0001 | 0.25892 | 74.0 | 1.0 | 80.1 | 0.9 | 172.0 | 7.0 |
| 2 | DGR-3-37.37-gr1.2 | 0.61 | 0.009 | 0.03 | 0.275 | 0.013 | 0.0146 | 0.0002 | 0.28813 | 83.0 | 1.3 | 93.6 | 1.2 | 246.5 | 10.2 |
| 3 | DGR-3-37.37-gr1.3 | 0.84 | 0.011 | 0.02 | 0.135 | 0.008 | 0.0127 | 0.0002 | 0.22345 | 78.6 | 1.1 | 81.6 | 1.0 | 128.5 | 6.8 |
| 4 | DGR-3-37.37-gr2.1 | 1.33 | 0.017 | 0.00 | 0.149 | 0.006 | 0.0125 | 0.0001 | 0.23626 | 76.2 | 0.8 | 80.1 | 0.8 | 141.3 | 5.4 |
| 5 | DGR-3-37.37-gr2.2 | 1.12 | 0.013 | 0.00 | 0.125 | 0.006 | 0.0120 | 0.0001 | 0.22159 | 74.1 | 0.9 | 76.9 | 0.8 | 119.8 | 5.6 |
| 6 | DGR-3-37.37-gr2.3 | 0.92 | 0.011 | 0.01 | 0.201 | 0.009 | 0.0121 | 0.0002 | 0.27213 | 70.2 | 1.0 | 77.4 | 1.0 | 185.9 | 7.8 |
| 7 | DGR-3-37.37-gr3.1 | 0.99 | 0.014 | 0.01 | 0.230 | 0.010 | 0.0145 | 0.0002 | 0.26774 | 85.2 | 1.1 | 93.1 | 1.1 | 209.9 | 8.1 |
| 8 | DGR-3-37.37-gr3.2 | 0.88 | 0.013 | 0.00 | 0.343 | 0.013 | 0.0146 | 0.0002 | 0.31549 | 79.1 | 1.2 | 93.6 | 1.1 | 299.6 | 10.1 |
| 9 | DGR-3-37.37-gr3.3 | 1.54 | 0.020 | 0.00 | 0.155 | 0.006 | 0.0133 | 0.0001 | 0.23424 | 80.9 | 0.8 | 84.9 | 0.7 | 146.2 | 5.1 |
| 10 | DGR-3-37.37-gr4.1 | 1.49 | 0.020 | 0.03 | 0.254 | 0.016 | 0.0136 | 0.0002 | 0.28604 | 77.2 | 1.6 | 86.9 | 1.5 | 229.5 | 12.7 |
| 11 | DGR-3-37.37-gr4.3 | 1.18 | 0.012 | 0.04 | 0.164 | 0.009 | 0.0101 | 0.0002 | 0.26719 | 59.2 | 1.0 | 65.0 | 1.0 | 154.2 | 8.1 |
| 12 | DGR-3-37.37-gr5.1 | 1.29 | 0.017 | 0.01 | 0.260 | 0.009 | 0.0133 | 0.0001 | 0.29225 | 75.0 | 0.9 | 85.2 | 0.8 | 234.3 | 7.1 |
| 13 | DGR-3-37.37-gr5.2 | 3.25 | 0.031 | 0.03 | 0.178 | 0.013 | 0.0096 | 0.0002 | 0.28257 | 54.7 | 1.4 | 61.6 | 1.3 | 166.4 | 11.2 |
| 14 | DGR-3-37.37-gr5.3 | 0.74 | 0.006 | 0.03 | 0.283 | 0.015 | 0.0086 | 0.0002 | 0.35443 | 41.9 | 1.2 | 55.4 | 1.1 | 253.1 | 12.2 |
| 15 | DGR-3-37.37-gr6.1 | 2.48 | 0.038 | 0.00 | 0.307 | 0.016 | 0.0152 | 0.0002 | 0.29680 | 85.0 | 1.6 | 97.2 | 1.5 | 271.9 | 12.3 |
| 16 | DGR-3-37.37-gr6.2 | 0.43 | 0.007 | 0.01 | 0.356 | 0.021 | 0.0152 | 0.0003 | 0.31453 | 82.4 | 2.0 | 97.5 | 1.8 | 309.2 | 15.8 |
| 17 | DGR-3-37.37-gr6.3 | 1.22 | 0.019 | 0.02 | 0.200 | 0.009 | 0.0152 | 0.0002 | 0.24734 | 91.6 | 1.1 | 97.5 | 1.1 | 185.2 | 7.5 |
| | ***DGR-4-73.73*** | ***Devonian Amherstburg Fm*** | | | | | | | | | | | | | |
| | ***May12-15a M150510*** | ***213nm*** | | | | | | | | | | | | | |
| 18 | DGR-4-73.73-gr1.1 | 0.05 | 0.007 | 0.04 | 14.946 | 1.956 | 0.1339 | 0.0108 | 0.61490 | 22.5 | 82.2 | 810.0 | 61.0 | 2811.8 | 119.3 |
| 19 | DGR-4-73.73-gr1.2 | 3.94 | 0.618 | 0.01 | 13.756 | 0.084 | 0.1568 | 0.0006 | 0.60181 | 246.7 | 4.0 | 939.0 | 3.2 | 2733.1 | 5.8 |
| 20 | DGR-4-73.73-gr2.1 | 3.20 | 0.024 | 0.01 | 0.080 | 0.004 | 0.0075 | 0.0001 | 0.22217 | 46.4 | 0.5 | 48.3 | 0.5 | 78.5 | 3.4 |
| 21 | DGR-4-73.73-gr2.2 | 1.60 | 0.012 | 0.01 | 0.113 | 0.006 | 0.0074 | 0.0001 | 0.25881 | 43.9 | 0.7 | 47.7 | 0.7 | 108.8 | 5.7 |
| 22 | DGR-4-73.73-gr2.3 | 4.28 | 0.021 | 0.06 | 0.048 | 0.002 | 0.0050 | 0.0001 | 0.21110 | 31.0 | 0.4 | 32.0 | 0.3 | 48.1 | 2.4 |
| 23 | DGR-4-73.73-gr3.1 | 3.13 | 0.056 | 0.02 | 1.373 | 0.085 | 0.0178 | 0.0005 | 0.47883 | 39.6 | 4.6 | 113.8 | 3.3 | 877.2 | 35.8 |
| 24 | DGR-4-73.73-gr3.2 | 2.10 | 0.017 | 0.02 | 0.311 | 0.032 | 0.0079 | 0.0003 | 0.37734 | 35.5 | 2.2 | 50.9 | 2.0 | 274.8 | 24.6 |
| 25 | DGR-4-73.73-gr3.3 | 0.08 | 0.001 | 0.11 | 1.164 | 0.138 | 0.0146 | 0.0008 | 0.47963 | 30.4 | 7.4 | 93.6 | 5.3 | 783.7 | 63.2 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | DGR-4-73.73-gr4.1 | 2.20 | 0.016 | 0.02 | 0.324 | 0.009 | 0.0075 | 0.0001 | 0.39192 | 31.5 | 0.6 | 47.9 | 0.5 | 284.9 | 7.1 |
| 27 | DGR-4-73.73-gr4.2 | 1.09 | 0.010 | 0.11 | 0.479 | 0.019 | 0.0091 | 0.0002 | 0.41800 | 33.8 | 1.2 | 58.7 | 1.0 | 397.2 | 13.2 |
| 28 | DGR-4-73.73-gr5.1 | 5.69 | 0.031 | 0.04 | 0.061 | 0.003 | 0.0055 | 0.0001 | 0.22258 | 34.0 | 0.5 | 35.4 | 0.4 | 59.7 | 3.2 |
| 29 | DGR-4-73.73-gr5.2 | 2.56 | 0.015 | 0.00 | 0.218 | 0.006 | 0.0058 | 0.0001 | 0.37109 | 26.5 | 0.5 | 37.2 | 0.4 | 200.1 | 5.4 |
| 30 | DGR-4-73.73-gr5.3 | 0.92 | 0.011 | 0.01 | 1.048 | 0.051 | 0.0117 | 0.0003 | 0.49188 | 17.7 | 2.7 | 75.3 | 1.8 | 727.9 | 25.1 |
| | ***May13-15a M150510*** | ***213nm*** | | | | | | | | | | | | | |
| 31 | DGR-4-73.73-gr4.3 | 3.16 | 0.020 | 0.01 | 0.086 | 0.004 | 0.0062 | 0.0001 | 0.24797 | 37.0 | 0.5 | 39.8 | 0.5 | 84.0 | 3.8 |
| 32 | DGR-4-73.73-gr2.4 | 2.08 | 0.014 | 0.01 | 0.094 | 0.006 | 0.0066 | 0.0001 | 0.24992 | 39.2 | 0.7 | 42.3 | 0.7 | 90.9 | 5.4 |
| 33 | DGR-4-73.73-gr2.5 | 1.67 | 0.012 | 0.07 | 0.109 | 0.007 | 0.0073 | 0.0001 | 0.25580 | 43.3 | 0.8 | 46.9 | 0.8 | 105.1 | 6.5 |
| 34 | DGR-4-73.73-gr2.6 | 2.69 | 0.012 | 0.02 | 0.062 | 0.004 | 0.0044 | 0.0001 | 0.24627 | 26.6 | 0.5 | 28.6 | 0.4 | 60.7 | 3.6 |
| 35 | DGR-4-73.73-gr3.5 | 2.49 | 0.012 | 0.02 | 0.078 | 0.006 | 0.0049 | 0.0001 | 0.26134 | 28.7 | 0.6 | 31.5 | 0.6 | 76.0 | 5.4 |
| 36 | DGR-4-73.73-gr5.4 | 1.39 | 0.007 | 0.01 | 0.145 | 0.008 | 0.0054 | 0.0001 | 0.32570 | 28.0 | 0.7 | 34.5 | 0.7 | 137.1 | 7.5 |
| 37 | DGR-4-73.73-gr5.5 | 0.74 | 0.005 | 0.02 | 0.245 | 0.023 | 0.0061 | 0.0002 | 0.37765 | 27.2 | 1.6 | 39.4 | 1.4 | 222.2 | 18.6 |
| 38 | DGR-4-73.73-gr5.6 | 0.82 | 0.005 | 0.09 | 0.145 | 0.014 | 0.0055 | 0.0002 | 0.32147 | 29.1 | 1.2 | 35.6 | 1.1 | 137.7 | 12.7 |
| 39 | DGR-4-73.73-gr5.7 | 1.86 | 0.012 | 0.11 | 0.088 | 0.006 | 0.0062 | 0.0001 | 0.24898 | 37.2 | 0.7 | 40.0 | 0.7 | 85.6 | 5.7 |
| | ***DGR-3-96.59*** | ***Devonian Bois Blanc Fm.*** | | | | | | | | | | | | | |
| | ***May12-15a M150510*** | ***213nm*** | | | | | | | | | | | | | |
| 40 | DGR-3-96.59-gr2.1 | 9.73 | 3.512 | 0.05 | 36.315 | 0.153 | 0.3610 | 0.0010 | 0.68385 | 293.3 | 6.5 | 1986.7 | 4.9 | 3675.1 | 4.2 |
| 41 | DGR-3-96.59-gr2.2 | 2.43 | 0.011 | 0.44 | 0.093 | 0.008 | 0.0047 | 0.0001 | 0.28790 | 26.3 | 0.8 | 30.1 | 0.7 | 90.7 | 7.2 |
| 42 | DGR-3-96.59-gr3.1 | 3.98 | 0.874 | 0.02 | 20.847 | 0.081 | 0.2193 | 0.0005 | 0.63466 | 250.4 | 3.7 | 1278.3 | 2.9 | 3131.5 | 3.8 |
| 43 | DGR-3-96.59-gr3.2 | 5.97 | 1.023 | 0.01 | 15.916 | 0.056 | 0.1715 | 0.0004 | 0.61430 | 218.6 | 2.6 | 1020.2 | 2.0 | 2871.8 | 3.3 |
| 44 | DGR-3-96.59-gr3.3 | 6.41 | 1.326 | 0.01 | 19.892 | 0.072 | 0.2069 | 0.0005 | 0.63022 | 223.0 | 3.3 | 1212.2 | 2.5 | 3086.1 | 3.5 |
| | ***DGR-1-113.55*** | ***Devonian Bois Blanc Fm.*** | | | | | | | | | | | | | |
| | ***Apr15-15a*** | ***213 nm*** | | | | | | | | | | | | | |
| 45 | DGR-1-113-gr1.1 | 1.32 | 0.013 | 0.28 | 0.681 | 0.079 | 0.0101 | 0.0004 | 0.35808 | 28.0 | 4.5 | 64.5 | 2.7 | 527.2 | 46.8 |
| 46 | DGR-1-113-gr1.2 | 2.88 | 0.694 | 0.01 | 22.588 | 0.097 | 0.2406 | 0.0006 | 0.53349 | 290.9 | 4.8 | 1390.0 | 2.9 | 3209.4 | 4.2 |
| 47 | DGR-1-113-gr2.2 | 2.04 | 0.214 | 0.01 | 9.481 | 0.058 | 0.1051 | 0.0003 | 0.46564 | 150.7 | 3.1 | 644.3 | 1.8 | 2385.7 | 5.6 |
| 48 | DGR-1-113-gr3.1 | 0.91 | 0.008 | 0.12 | 0.208 | 0.011 | 0.0088 | 0.0001 | 0.23086 | 47.8 | 0.8 | 56.7 | 0.7 | 191.9 | 9.1 |
| 49 | DGR-1-113-gr3.2 | 0.24 | 0.003 | 1.18 | 0.569 | 0.041 | 0.0142 | 0.0003 | 0.29371 | 62.8 | 2.7 | 90.9 | 1.9 | 457.4 | 26.3 |
| 50 | DGR-1-113-gr4.1 | 1.63 | 0.007 | 0.03 | 0.264 | 0.019 | 0.0046 | 0.0001 | 0.33366 | 15.6 | 1.1 | 29.5 | 0.7 | 237.9 | 14.9 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | DGR-1-113-gr4.2 | 1.36 | 0.005 | 0.05 | 0.261 | 0.019 | 0.0034 | 0.0001 | 0.37242 | 7.4 | 1.0 | 21.7 | 0.6 | 235.2 | 14.8 |
| 52 | DGR-1-113-gr5.1 | 0.06 | 0.003 | 4.23 | 6.233 | 0.333 | 0.0634 | 0.0015 | 0.44607 | 60.8 | 17.7 | 396.3 | 9.1 | 2009.1 | 45.9 |
| 53 | DGR-1-113-gr5.2 | 0.30 | 0.005 | 0.19 | 0.783 | 0.048 | 0.0174 | 0.0003 | 0.30997 | 71.5 | 3.0 | 111.0 | 2.1 | 587.4 | 26.8 |
| 54 | DGR-1-113-gr6.1 | 0.16 | 0.006 | 0.29 | 2.395 | 0.122 | 0.0367 | 0.0007 | 0.36999 | 106.8 | 7.0 | 232.1 | 4.3 | 1241.1 | 36.1 |
| 55 | DGR-1-113-gr6.2 | 0.82 | 0.009 | 0.10 | 0.343 | 0.017 | 0.0106 | 0.0001 | 0.26556 | 51.7 | 1.2 | 68.0 | 0.9 | 299.4 | 12.6 |
| | ***Apr24-15a LA150422*** | ***213nm*** | | | | | | | | | | | | | |
| 56 | DGR-1-113-gr1.1 | 0.27 | 0.005 | 0.57 | 1.031 | 0.070 | 0.0203 | 0.0004 | 0.32510 | 76.9 | 4.3 | 129.7 | 2.8 | 719.3 | 34.4 |
| 57 | DGR-1-113-gr1.2 | 0.90 | 0.009 | 0.10 | 0.277 | 0.015 | 0.0104 | 0.0001 | 0.24441 | 54.1 | 1.2 | 66.5 | 0.9 | 248.6 | 12.2 |
| 58 | DGR-1-113-gr1.3 | 1.20 | 0.014 | 0.39 | 0.425 | 0.018 | 0.0116 | 0.0001 | 0.28079 | 53.7 | 1.2 | 74.4 | 0.9 | 359.6 | 13.0 |
| 59 | DGR-1-113-gr1.4 | 0.58 | 0.014 | 0.00 | 1.938 | 0.071 | 0.0243 | 0.0003 | 0.38846 | 50.4 | 4.0 | 155.0 | 2.2 | 1094.3 | 24.4 |
| 60 | DGR-1-113-gr1.5 | 4.66 | 0.860 | 0.01 | 16.663 | 0.064 | 0.1845 | 0.0004 | 0.49372 | 262.0 | 3.3 | 1091.5 | 1.9 | 2915.6 | 3.7 |
| 61 | DGR-1-113-gr1.6 | 0.12 | 0.001 | 0.19 | 1.017 | 0.102 | 0.0127 | 0.0005 | 0.38230 | 25.8 | 5.7 | 81.1 | 3.1 | 712.2 | 50.5 |
| 62 | DGR-1-113-gr2.1 | 1.12 | 0.011 | 0.29 | 0.274 | 0.019 | 0.0096 | 0.0002 | 0.25172 | 48.8 | 1.4 | 61.3 | 1.1 | 245.8 | 14.9 |
| 63 | DGR-1-113-gr2.2 | 0.93 | 0.009 | 0.23 | 0.209 | 0.012 | 0.0098 | 0.0001 | 0.22072 | 54.4 | 1.0 | 63.0 | 0.8 | 192.5 | 9.9 |
| 64 | DGR-1-113-gr3.1 | 1.70 | 0.004 | 0.12 | 0.134 | 0.014 | 0.0022 | 0.0001 | 0.34090 | 6.8 | 0.8 | 14.0 | 0.5 | 127.5 | 12.6 |
| 65 | DGR-1-113-gr5.1 | 2.69 | 0.021 | 0.09 | 0.093 | 0.005 | 0.0077 | 0.0001 | 0.17014 | 47.0 | 0.5 | 49.6 | 0.4 | 90.7 | 4.5 |
| 66 | DGR-1-113-gr5.2 | 2.70 | 0.022 | 0.09 | 0.121 | 0.008 | 0.0083 | 0.0001 | 0.18479 | 49.5 | 0.7 | 53.5 | 0.6 | 115.7 | 6.8 |
| 67 | DGR-1-113-gr6.1 | 0.65 | 0.006 | 0.44 | 0.746 | 0.057 | 0.0091 | 0.0003 | 0.38400 | 17.3 | 3.2 | 58.2 | 1.7 | 566.1 | 32.7 |
| 68 | DGR-1-113-gr6.2 | 0.37 | 0.006 | 0.25 | 1.220 | 0.082 | 0.0173 | 0.0004 | 0.36739 | 45.3 | 4.7 | 110.7 | 2.7 | 809.8 | 36.9 |
| 69 | DGR-1-113-gr7.1 | 3.04 | 0.022 | 0.11 | 0.102 | 0.005 | 0.0072 | 0.0001 | 0.18251 | 42.9 | 0.5 | 46.2 | 0.4 | 98.3 | 4.4 |
| 70 | DGR-1-113-gr7.2 | 3.22 | 0.023 | 0.09 | 0.079 | 0.004 | 0.0072 | 0.0001 | 0.16172 | 44.5 | 0.4 | 46.5 | 0.4 | 77.1 | 3.8 |
| 71 | DGR-1-113-gr8.1 | 1.93 | 0.016 | 0.16 | 0.223 | 0.010 | 0.0084 | 0.0001 | 0.24299 | 44.0 | 0.7 | 54.0 | 0.6 | 204.3 | 7.9 |
| 72 | DGR-1-113-gr8.2 | 1.23 | 0.011 | 0.08 | 0.225 | 0.013 | 0.0092 | 0.0001 | 0.23440 | 49.1 | 1.0 | 58.9 | 0.8 | 205.8 | 10.3 |
| 73 | DGR-1-113-gr12.1 | 6.03 | 0.006 | 0.00 | 0.095 | 0.006 | 0.0010 | 0.0000 | 0.39415 | 1.4 | 0.3 | 6.7 | 0.2 | 92.6 | 5.6 |
| 74 | DGR-1-113-gr12.2 | 4.45 | 0.005 | 0.00 | 0.103 | 0.008 | 0.0012 | 0.0000 | 0.38882 | 1.8 | 0.4 | 7.5 | 0.2 | 99.9 | 7.4 |
| 75 | DGR-1-113-gr12.3 | 3.44 | 0.005 | 0.00 | 0.146 | 0.010 | 0.0016 | 0.0000 | 0.39383 | 2.1 | 0.6 | 10.3 | 0.3 | 138.7 | 8.9 |
| 76 | DGR-1-113-gr11.1 | 0.39 | 0.004 | 0.13 | 0.888 | 0.044 | 0.0092 | 0.0002 | 0.40452 | 10.2 | 2.4 | 59.3 | 1.2 | 645.1 | 23.4 |
| 77 | DGR-1-113-gr11.2 | 0.36 | 0.003 | 0.14 | 0.701 | 0.078 | 0.0089 | 0.0004 | 0.37643 | 19.3 | 4.4 | 57.4 | 2.4 | 539.1 | 45.9 |
| 78 | DGR-1-113-gr10.1 | 0.24 | 0.010 | 2.92 | 2.990 | 0.111 | 0.0430 | 0.0006 | 0.37880 | 114.5 | 6.3 | 271.4 | 3.7 | 1405.1 | 27.9 |
| 79 | DGR-1-113-gr10.2 | 2.08 | 0.018 | 0.37 | 0.153 | 0.008 | 0.0086 | 0.0001 | 0.20308 | 49.6 | 0.7 | 55.4 | 0.6 | 144.8 | 6.8 |
| 80 | DGR-1-113-gr10.3 | 2.20 | 0.017 | 0.09 | 0.099 | 0.005 | 0.0079 | 0.0001 | 0.17280 | 47.9 | 0.5 | 50.7 | 0.4 | 95.9 | 4.5 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | DGR-1-113-gr10.4 | 0.19 | 0.003 | 0.35 | 0.793 | 0.054 | 0.0152 | 0.0003 | 0.32541 | 56.5 | 3.3 | 97.5 | 2.2 | 593.0 | 30.3 |
| 82 | DGR-1-113-gr9.1 | 0.20 | 0.003 | 10.5 | 0.834 | 0.066 | 0.0160 | 0.0004 | 0.32613 | 59.0 | 4.0 | 102.1 | 2.6 | 615.9 | 36.2 |
| 83 | DGR-1-113-gr9.2 | 1.81 | 0.014 | 0.10 | 0.121 | 0.007 | 0.0078 | 0.0001 | 0.19008 | 45.9 | 0.7 | 50.1 | 0.6 | 115.6 | 6.5 |
| 84 | DGR-1-113-gr9.3 | 1.23 | 0.011 | 0.13 | 0.205 | 0.013 | 0.0092 | 0.0001 | 0.22531 | 50.2 | 1.1 | 58.8 | 0.9 | 189.0 | 11.1 |
| | ***May15-15a M150430*** | ***213nm*** | | | | | | | | | | | | | |
| 85 | DGR-1-113-gr1.1rim | 1.29 | 0.029 | 0.00 | 1.861 | 0.046 | 0.0224 | 0.0003 | 0.49282 | 41.6 | 2.4 | 142.6 | 1.7 | 1067.3 | 16.3 |
| 86 | DGR-1-113-gr1.2rim | 0.41 | 0.020 | 0.00 | 4.257 | 0.128 | 0.0491 | 0.0008 | 0.51933 | 81.1 | 6.6 | 309.2 | 4.7 | 1685.1 | 24.5 |
| 87 | DGR-1-113-gr1.3rim | 1.80 | 0.017 | 0.00 | 0.768 | 0.018 | 0.0095 | 0.0001 | 0.47865 | 19.0 | 0.9 | 61.0 | 0.7 | 578.6 | 10.1 |
| 88 | DGR-1-113-gr1.4core | 4.51 | 0.004 | 0.00 | 0.075 | 0.004 | 0.0009 | 0.0000 | 0.46989 | 1.9 | 0.2 | 6.0 | 0.1 | 73.5 | 3.7 |
| 89 | DGR-1-113-gr1.5core | 2.30 | 0.003 | 0.01 | 0.124 | 0.010 | 0.0014 | 0.0001 | 0.48298 | 2.1 | 0.5 | 8.9 | 0.3 | 118.3 | 8.7 |
| 90 | DGR-1-113-gr1.6core | 2.83 | 0.364 | 0.01 | 11.185 | 0.945 | 0.1285 | 0.0062 | 0.57247 | 207.7 | 46.4 | 779.3 | 35.4 | 2538.6 | 76.5 |
| | ***Jun24-15a*** | ***193 nm*** | | | | | | | | | | | | | |
| 91 | DGR1-113-1.1 | 0.14 | 0.001 | 0.10 | 0.584 | 0.035 | 0.0093 | 0.0003 | 0.49406 | 28.4 | 2.0 | 59.5 | 1.7 | 467.1 | 22.2 |
| 92 | DGR1-113-1.2 | 1.72 | 0.002 | 0.04 | 0.113 | 0.005 | 0.0014 | 0.0000 | 0.52392 | 2.6 | 0.3 | 8.8 | 0.2 | 108.7 | 4.4 |
| 93 | DGR1-113-1.3 | 0.75 | 0.002 | 0.02 | 0.151 | 0.006 | 0.0021 | 0.0000 | 0.50729 | 5.3 | 0.3 | 13.5 | 0.3 | 142.9 | 5.2 |
| 94 | DGR1-113-1.4 | 1.26 | 0.004 | 0.00 | 0.267 | 0.010 | 0.0034 | 0.0001 | 0.52029 | 7.0 | 0.5 | 21.6 | 0.4 | 240.0 | 7.7 |
| 95 | DGR1-113-1.5 | 0.35 | 0.001 | 0.00 | 0.286 | 0.014 | 0.0039 | 0.0001 | 0.50938 | 9.8 | 0.7 | 25.4 | 0.6 | 255.7 | 10.7 |
| 96 | DGR1-113-3.1 | 0.19 | 0.002 | 1.21 | 0.414 | 0.018 | 0.0121 | 0.0002 | 0.41374 | 57.7 | 1.4 | 77.5 | 1.3 | 351.7 | 12.5 |
| 97 | DGR1-113-3.2 | 0.50 | 0.004 | 0.08 | 0.122 | 0.005 | 0.0087 | 0.0001 | 0.29501 | 51.9 | 0.7 | 55.7 | 0.7 | 116.7 | 4.8 |
| 98 | DGR1-113-3.3 | 0.38 | 0.004 | 0.47 | 0.203 | 0.009 | 0.0099 | 0.0001 | 0.34404 | 55.0 | 1.0 | 63.2 | 0.9 | 187.6 | 7.4 |
| 99 | DGR1-113-3.4 | 0.05 | 0.001 | 0.81 | 0.543 | 0.041 | 0.0104 | 0.0004 | 0.46935 | 38.8 | 2.5 | 66.9 | 2.3 | 440.1 | 26.5 |
| 100 | DGR1-113-3.5 | 0.36 | 0.003 | 0.14 | 0.137 | 0.007 | 0.0090 | 0.0001 | 0.30593 | 52.9 | 0.9 | 57.6 | 0.9 | 130.8 | 6.1 |
| 101 | DGR1-113-4.1 | 0.22 | 0.001 | 0.38 | 0.126 | 0.008 | 0.0043 | 0.0001 | 0.38824 | 22.0 | 0.7 | 27.9 | 0.7 | 120.6 | 6.9 |
| 102 | DGR1-113-4.2 | 0.10 | 0.000 | 1.47 | 0.208 | 0.016 | 0.0047 | 0.0002 | 0.44416 | 19.9 | 1.1 | 30.4 | 1.1 | 191.9 | 13.8 |
| 103 | DGR1-113-4.3 | 0.11 | 0.000 | 0.73 | 0.173 | 0.014 | 0.0041 | 0.0001 | 0.43690 | 18.0 | 1.0 | 26.7 | 0.9 | 162.0 | 11.8 |
| 104 | DGR1-113-4.5 | 0.58 | 0.005 | 0.16 | 0.092 | 0.004 | 0.0081 | 0.0001 | 0.26990 | 49.7 | 0.6 | 52.0 | 0.6 | 89.4 | 3.5 |
| | ***Jun24-15b*** | ***193 nm*** | | | | | | | | | | | | | |
| 132 | DGR1-113-1.1 | 1.21 | 0.002 | 0.00 | 0.126 | 0.012 | 0.0019 | 0.0001 | 0.49882 | 5.2 | 0.7 | 12.1 | 0.6 | 120.8 | 11.1 |
| 133 | DGR1-113-1.2 | 1.05 | 0.002 | 0.00 | 0.099 | 0.008 | 0.0015 | 0.0001 | 0.49969 | 4.0 | 0.4 | 9.4 | 0.4 | 96.0 | 7.1 |
| 134 | DGR1-113-1.3 | 1.03 | 0.002 | 0.00 | 0.087 | 0.011 | 0.0015 | 0.0001 | 0.47852 | 5.1 | 0.6 | 9.7 | 0.6 | 85.0 | 9.8 |
| 135 | DGR1-113-1.4 | 1.11 | 0.002 | 0.00 | 0.088 | 0.009 | 0.0017 | 0.0001 | 0.46764 | 6.0 | 0.6 | 10.6 | 0.5 | 85.4 | 8.3 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | DGR1-113-1.5 | 1.28 | 0.002 | 0.00 | 0.113 | 0.011 | 0.0016 | 0.0001 | 0.50233 | 4.3 | 0.6 | 10.4 | 0.5 | 108.4 | 9.7 |
| 137 | DGR1-113-2.1 | 2.08 | 0.002 | 0.01 | 0.084 | 0.009 | 0.0011 | 0.0001 | 0.51628 | 2.3 | 0.5 | 6.9 | 0.4 | 81.4 | 8.1 |
| 138 | DGR1-113-2.2 | 4.25 | 0.004 | 0.01 | 0.056 | 0.007 | 0.0010 | 0.0001 | 0.47483 | 3.5 | 0.4 | 6.5 | 0.4 | 55.8 | 6.8 |
| 139 | DGR1-113-2.3 | 2.51 | 0.004 | 0.00 | 0.110 | 0.007 | 0.0016 | 0.0000 | 0.50254 | 4.2 | 0.4 | 10.2 | 0.3 | 106.1 | 6.1 |
| 140 | DGR1-113-2.4 | 2.24 | 0.004 | 0.00 | 0.127 | 0.009 | 0.0017 | 0.0001 | 0.51034 | 4.1 | 0.5 | 11.0 | 0.4 | 121.0 | 7.8 |
| 141 | DGR1-113-2.5 | 2.27 | 0.002 | 0.00 | 0.078 | 0.007 | 0.0010 | 0.0000 | 0.51240 | 2.4 | 0.4 | 6.7 | 0.3 | 76.5 | 6.2 |
| 142 | DGR1-113-3.1 | 0.72 | 0.005 | 0.00 | 0.422 | 0.015 | 0.0064 | 0.0001 | 0.49839 | 18.5 | 0.9 | 41.1 | 0.7 | 357.4 | 10.8 |
| 143 | DGR1-113-3.2 | 1.85 | 0.005 | 0.00 | 0.178 | 0.016 | 0.0025 | 0.0001 | 0.50617 | 6.4 | 0.9 | 16.0 | 0.7 | 165.9 | 14.0 |
| 144 | DGR1-113-3.3 | 1.99 | 0.005 | 0.00 | 0.200 | 0.014 | 0.0027 | 0.0001 | 0.50942 | 6.7 | 0.8 | 17.5 | 0.6 | 184.8 | 11.7 |
| 145 | DGR1-113-3.4 | 1.94 | 0.006 | 0.00 | 0.212 | 0.019 | 0.0030 | 0.0001 | 0.50580 | 7.7 | 1.0 | 19.2 | 0.9 | 195.6 | 15.6 |
| 146 | DGR1-113-3.5 | 2.34 | 0.004 | 0.00 | 0.129 | 0.010 | 0.0018 | 0.0001 | 0.50525 | 4.7 | 0.6 | 11.7 | 0.5 | 123.6 | 9.3 |
| 147 | DGR1-113-3.6 | 0.98 | 0.005 | 0.00 | 0.412 | 0.013 | 0.0055 | 0.0001 | 0.51304 | 13.1 | 0.7 | 35.5 | 0.6 | 350.0 | 9.1 |
| | ***DGR-3-113.17*** | ***Devonian Bois Blanc Fm.*** | | | | | | | | | | | | | |
| | ***May8-15b M150508*** | ***213 nm*** | | | | | | | | | | | | | |
| 105 | DGR-3-113-gr1.1 | 3.65 | 0.010 | 0.20 | 0.032 | 0.003 | 0.0026 | 0.0001 | 0.23182 | 16.0 | 0.4 | 16.9 | 0.3 | 32.1 | 2.7 |
| 106 | DGR-3-113-gr1.2 | 6.91 | 0.017 | 0.02 | 0.023 | 0.002 | 0.0024 | 0.0000 | 0.20888 | 15.0 | 0.3 | 15.5 | 0.3 | 23.4 | 2.0 |
| 107 | DGR-3-113-gr1.3 | 6.66 | 0.016 | 0.03 | 0.017 | 0.002 | 0.0024 | 0.0000 | 0.18141 | 15.4 | 0.3 | 15.5 | 0.3 | 17.2 | 1.7 |
| 108 | DGR-3-113-gr2.1 | 0.99 | 0.004 | 0.09 | 0.127 | 0.013 | 0.0036 | 0.0001 | 0.35955 | 17.0 | 1.0 | 23.1 | 0.8 | 121.3 | 11.6 |
| 109 | DGR-3-113-gr2.2 | 2.84 | 0.007 | 0.02 | 0.047 | 0.004 | 0.0026 | 0.0001 | 0.27435 | 15.0 | 0.4 | 16.8 | 0.4 | 46.7 | 4.2 |
| 110 | DGR-3-113-gr2.3 | 3.18 | 0.011 | 0.06 | 0.050 | 0.005 | 0.0036 | 0.0001 | 0.24634 | 21.3 | 0.6 | 22.9 | 0.6 | 49.4 | 4.8 |
| 111 | DGR-3-113-gr3.1 | 11.32 | 0.063 | 0.03 | 0.294 | 0.008 | 0.0056 | 0.0001 | 0.41800 | 20.7 | 0.5 | 36.0 | 0.4 | 261.7 | 6.6 |
| 112 | DGR-3-113-gr3.3 | 6.79 | 0.047 | 0.06 | 0.432 | 0.016 | 0.0069 | 0.0001 | 0.44157 | 21.2 | 0.9 | 44.2 | 0.7 | 364.8 | 11.1 |
| 113 | DGR-3-113-gr3.2 | 9.63 | 0.041 | 0.04 | 0.122 | 0.006 | 0.0042 | 0.0001 | 0.33521 | 21.4 | 0.5 | 27.1 | 0.5 | 117.3 | 5.7 |
| 114 | DGR-3-113-gr4.1 | 2.16 | 0.006 | 0.05 | 0.044 | 0.005 | 0.0026 | 0.0001 | 0.26732 | 15.0 | 0.5 | 16.7 | 0.5 | 43.8 | 4.7 |
| 115 | DGR-3-113-gr4.2 | 2.25 | 0.006 | 0.18 | 0.046 | 0.005 | 0.0028 | 0.0001 | 0.26296 | 16.4 | 0.5 | 18.1 | 0.5 | 45.7 | 4.8 |
| 116 | DGR-3-113-gr4.3 | 2.24 | 0.009 | 0.08 | 0.052 | 0.005 | 0.0039 | 0.0001 | 0.24125 | 23.5 | 0.6 | 25.1 | 0.5 | 51.5 | 4.5 |
| 117 | DGR-3-113-gr5.1 | 7.00 | 0.018 | 0.13 | 0.026 | 0.003 | 0.0026 | 0.0001 | 0.21102 | 16.3 | 0.4 | 16.8 | 0.4 | 26.1 | 2.8 |
| 118 | DGR-3-113-gr5.2 | 2.54 | 0.009 | 0.11 | 0.086 | 0.013 | 0.0037 | 0.0002 | 0.30712 | 19.9 | 1.2 | 23.6 | 1.1 | 84.1 | 12.0 |
| 119 | DGR-3-113-gr5.3 | 3.19 | 0.012 | 0.36 | 0.050 | 0.005 | 0.0036 | 0.0001 | 0.24674 | 21.7 | 0.6 | 23.3 | 0.6 | 49.9 | 4.9 |
| 120 | DGR-3-113-gr6.1 | 1.16 | 0.003 | 0.00 | 0.151 | 0.016 | 0.0029 | 0.0001 | 0.41253 | 10.8 | 1.0 | 18.6 | 0.8 | 142.5 | 13.7 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | DGR-3-113-gr6.2 | 0.56 | 0.003 | 0.08 | 0.136 | 0.017 | 0.0051 | 0.0002 | 0.32398 | 26.8 | 1.4 | 32.9 | 1.3 | 129.3 | 14.9 |
| 122 | DGR-3-113-gr6.3 | 0.21 | 0.003 | 2.02 | 0.481 | 0.053 | 0.0148 | 0.0006 | 0.35739 | 72.1 | 4.1 | 94.8 | 3.7 | 399.0 | 35.9 |
| 123 | DGR-3-113-gr7.1 | 0.18 | 0.004 | 2.96 | 0.862 | 0.083 | 0.0197 | 0.0008 | 0.40123 | 82.9 | 5.5 | 126.0 | 4.8 | 631.1 | 44.3 |
| 124 | DGR-3-113-gr7.2 | 0.18 | 0.003 | 2.45 | 0.888 | 0.086 | 0.0180 | 0.0007 | 0.41643 | 69.9 | 5.4 | 115.3 | 4.6 | 645.2 | 45.5 |
| 125 | DGR-3-113-gr7.3 | 1.04 | 0.008 | 0.19 | 0.124 | 0.011 | 0.0081 | 0.0002 | 0.25986 | 47.6 | 1.3 | 51.8 | 1.2 | 118.7 | 10.1 |
| 126 | DGR-3-113-gr8.1 | 0.08 | 0.004 | 1.46 | 3.378 | 0.287 | 0.0465 | 0.0019 | 0.49215 | 115.0 | 15.5 | 292.8 | 12.0 | 1499.2 | 64.9 |
| 127 | DGR-3-113-gr9.1 | 0.27 | 0.005 | 0.83 | 0.865 | 0.068 | 0.0170 | 0.0006 | 0.42013 | 64.2 | 4.2 | 108.7 | 3.6 | 633.1 | 36.5 |
| 128 | DGR-3-113-gr9.2 | 0.16 | 0.003 | 1.31 | 0.842 | 0.101 | 0.0173 | 0.0009 | 0.41396 | 67.5 | 6.4 | 110.4 | 5.4 | 620.1 | 54.5 |
| 129 | DGR-3-113-gr9.3 | 0.32 | 0.004 | 2.35 | 0.338 | 0.037 | 0.0121 | 0.0004 | 0.33463 | 62.3 | 3.0 | 77.6 | 2.8 | 295.7 | 27.5 |
| 130 | DGR-3-113-gr10.1 | 2.63 | 0.006 | 0.01 | 0.051 | 0.005 | 0.0023 | 0.0001 | 0.29693 | 12.8 | 0.5 | 14.9 | 0.4 | 50.2 | 4.9 |
| 131 | DGR-3-113-gr10.2 | 1.99 | 0.006 | 0.17 | 0.045 | 0.005 | 0.0031 | 0.0001 | 0.25153 | 18.4 | 0.6 | 19.9 | 0.5 | 45.2 | 4.7 |
| | ***DGR-1-120.18*** | ***Devonian, Bois Blanc Fm.*** | | | | | | | | | | | | | |
| | ***May12-15a M150510*** | ***213 nm*** | | | | | | | | | | | | | |
| 148 | DGR-1-120.18-gr1.1 | 0.69 | 0.006 | 0.40 | 0.304 | 0.022 | 0.0093 | 0.0002 | 0.35393 | 45.1 | 1.6 | 59.6 | 1.5 | 269.7 | 16.7 |
| 149 | DGR-1-120.18-gr1.2 | 0.32 | 0.005 | 0.64 | 0.774 | 0.040 | 0.0151 | 0.0003 | 0.41999 | 56.5 | 2.5 | 96.4 | 2.1 | 581.9 | 22.7 |
| 150 | DGR-1-120.18-gr1.3 | 0.24 | 0.005 | 0.46 | 1.162 | 0.073 | 0.0191 | 0.0005 | 0.44677 | 60.8 | 4.2 | 121.9 | 3.4 | 782.9 | 34.0 |
| 151 | DGR-1-120.18-gr2.1 | 5.14 | 1.007 | 0.02 | 18.230 | 0.082 | 0.1959 | 0.0005 | 0.62239 | 246.4 | 3.8 | 1153.0 | 2.9 | 3001.9 | 4.3 |
| 152 | DGR-1-120.18-gr2.2 | 6.45 | 1.119 | 0.01 | 15.489 | 0.063 | 0.1735 | 0.0004 | 0.60850 | 256.8 | 3.0 | 1031.2 | 2.4 | 2845.8 | 3.9 |
| 153 | DGR-1-120.18-gr2.3 | 5.25 | 1.112 | 0.01 | 19.725 | 0.079 | 0.2118 | 0.0005 | 0.62812 | 265.6 | 3.6 | 1238.5 | 2.8 | 3078.0 | 3.9 |
| 154 | DGR-1-120.18-gr3.1 | 0.82 | 0.007 | 0.25 | 0.203 | 0.011 | 0.0089 | 0.0002 | 0.30740 | 48.5 | 1.0 | 57.1 | 1.0 | 187.8 | 9.5 |
| 155 | DGR-1-120.18-gr3.2 | 1.51 | 0.013 | 0.19 | 0.129 | 0.011 | 0.0085 | 0.0002 | 0.25868 | 50.0 | 1.2 | 54.4 | 1.1 | 123.3 | 9.4 |
| | ***May13-15a M150510*** | ***213 nm*** | | | | | | | | | | | | | |
| 156 | DGR-1-120.18-gr1.4 | 1.17 | 0.009 | 0.29 | 0.162 | 0.010 | 0.0081 | 0.0001 | 0.29032 | 45.3 | 1.0 | 51.8 | 0.9 | 152.1 | 8.8 |
| 157 | DGR-1-120.18-gr1.5 | 0.42 | 0.004 | 0.55 | 0.258 | 0.021 | 0.0091 | 0.0003 | 0.33493 | 46.3 | 1.8 | 58.2 | 1.6 | 233.3 | 17.2 |
| 158 | DGR-1-120.18-gr1.6 | 0.87 | 0.008 | 0.66 | 0.182 | 0.013 | 0.0089 | 0.0002 | 0.29400 | 49.4 | 1.3 | 56.8 | 1.2 | 170.1 | 11.3 |
| | ***DGR-3-133.17*** | ***Devonian Bois Blanc Fm.*** | | | | | | | | | | | | | |
| | ***Apr10-15a*** | ***213 nm*** | | | | | | | | | | | | | |
| 159 | DGR-3-133-gr1.1 | 0.25 | 0.005 | 0.00 | 1.305 | 0.069 | 0.0211 | 0.0004 | 0.35202 | 66.0 | 4.0 | 134.6 | 2.5 | 847.7 | 29.8 |
| | ***Apr12-15a*** | ***213 nm*** | | | | | | | | | | | | | |
| 160 | DGR-3-133-gr1.1 | 1.14 | 0.002 | 0.00 | 0.108 | 0.009 | 0.0020 | 0.0001 | 0.32164 | 7.2 | 0.6 | 12.9 | 0.4 | 103.9 | 8.5 |

| | Spot | U (ppm) | Pb206 (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 161 | DGR-3-133-gr1.2 | 0.13 | 0.005 | 0.01 | 3.900 | 0.152 | 0.0357 | 0.0006 | 0.44316 | 10.7 | 8.1 | 225.8 | 3.8 | 1613.7 | 31.1 |
| 162 | DGR-3-133-gr4.1 | 0.11 | 0.021 | 0.00 | 22.301 | 0.447 | 0.2016 | 0.0022 | 0.53856 | 46.1 | 22.4 | 1184.2 | 11.7 | 3196.9 | 19.3 |
| 163 | DGR-3-133-gr4.2 | 1.66 | 0.003 | 0.00 | 0.063 | 0.004 | 0.0016 | 0.0000 | 0.28341 | 7.3 | 0.3 | 10.4 | 0.2 | 62.2 | 4.3 |
| | ***Jun24-15a*** | ***193 nm*** | | | | | | | | | | | | | |
| 164 | DGR3-133-1.1 | 0.04 | 0.000 | 0.00 | 0.736 | 0.098 | 0.0071 | 0.0005 | 0.55271 | 4.3 | 4.8 | 45.4 | 3.3 | 560.0 | 56.1 |
| 165 | DGR3-133-1.2 | 0.01 | 0.000 | 0.00 | 1.058 | 0.144 | 0.0103 | 0.0008 | 0.55269 | 7.2 | 7.2 | 66.1 | 5.0 | 732.8 | 69.4 |
| 166 | DGR3-133-1.3 | 0.02 | 0.000 | 0.00 | 1.000 | 0.133 | 0.0106 | 0.0008 | 0.54339 | 12.7 | 6.7 | 67.9 | 4.9 | 703.7 | 66.1 |
| 167 | DGR3-133-1.4 | 0.03 | 0.000 | 0.00 | 0.775 | 0.097 | 0.0085 | 0.0006 | 0.53804 | 12.1 | 5.0 | 54.8 | 3.7 | 582.7 | 54.6 |
| 168 | DGR3-133-1.5 | 0.03 | 0.000 | 0.00 | 0.598 | 0.080 | 0.0072 | 0.0005 | 0.52760 | 13.2 | 4.1 | 46.0 | 3.2 | 475.7 | 49.6 |
| 169 | DGR3-133-3.1 | 0.86 | 0.002 | 0.00 | 0.029 | 0.002 | 0.0021 | 0.0000 | 0.29043 | 12.5 | 0.2 | 13.4 | 0.2 | 28.7 | 1.7 |
| 170 | DGR3-133-3.2 | 0.37 | 0.001 | 0.00 | 0.061 | 0.004 | 0.0026 | 0.0001 | 0.35640 | 14.3 | 0.4 | 16.9 | 0.4 | 59.9 | 4.2 |
| 171 | DGR3-133-3.3 | 0.43 | 0.001 | 0.00 | 0.050 | 0.005 | 0.0023 | 0.0001 | 0.34988 | 12.5 | 0.5 | 14.6 | 0.5 | 49.3 | 4.6 |
| | ***Jun24-15b*** | ***193 nm*** | | | | | | | | | | | | | |
| 172 | DGR3-133-3.7 | 0.81 | 0.002 | 0.00 | 0.033 | 0.003 | 0.0022 | 0.0001 | 0.30079 | 12.9 | 0.4 | 14.0 | 0.4 | 32.8 | 2.9 |
| 173 | DGR3-133-3.8 | 0.01 | 0.000 | 0.00 | 2.605 | 0.462 | 0.0301 | 0.0029 | 0.54202 | 49.6 | 23.5 | 190.9 | 18.0 | 1302.2 | 124.2 |
| 174 | DGR3-133-3.9 | 0.02 | 0.000 | 0.00 | 1.539 | 0.162 | 0.0147 | 0.0009 | 0.55648 | 8.4 | 8.0 | 93.9 | 5.5 | 946.1 | 63.2 |
| 175 | DGR3-133-3.10 | 0.77 | 0.002 | 0.00 | 0.030 | 0.002 | 0.0020 | 0.0000 | 0.30036 | 11.8 | 0.2 | 12.8 | 0.2 | 29.9 | 1.8 |
| 176 | DGR3-133-5.2 | 0.01 | 0.000 | 0.03 | 0.783 | 0.150 | 0.0097 | 0.0010 | 0.52445 | 19.4 | 7.8 | 62.1 | 6.2 | 587.2 | 82.6 |
| 177 | DGR3-133-5.3 | 0.02 | 0.000 | 0.00 | 0.369 | 0.098 | 0.0049 | 0.0007 | 0.51308 | 11.6 | 5.2 | 31.7 | 4.3 | 318.9 | 70.5 |
| 178 | DGR3-133-5.4 | 0.08 | 0.000 | 0.00 | 0.248 | 0.038 | 0.0032 | 0.0003 | 0.51680 | 7.0 | 2.0 | 20.5 | 1.6 | 224.7 | 30.4 |
| 179 | DGR3-133-5.5 | 0.01 | 0.000 | 0.00 | 1.580 | 0.257 | 0.0170 | 0.0015 | 0.54426 | 21.9 | 13.0 | 108.8 | 9.5 | 962.5 | 97.6 |
| 180 | DGR3-133-2.3 | 0.02 | 0.000 | 0.33 | 0.783 | 0.102 | 0.0067 | 0.0005 | 0.56422 | -0.7 | 4.3 | 43.2 | 3.2 | 587.0 | 56.8 |
| 181 | DGR3-133-2.5 | 0.02 | 0.000 | 0.00 | 0.673 | 0.088 | 0.0067 | 0.0005 | 0.54884 | 5.4 | 4.4 | 42.8 | 3.1 | 522.2 | 52.7 |
| 182 | DGR3-133-2.6 | 0.05 | 0.000 | 0.00 | 0.277 | 0.038 | 0.0041 | 0.0003 | 0.50106 | 11.2 | 2.1 | 26.1 | 1.8 | 248.1 | 29.7 |
| 183 | DGR3-133-2.7 | 0.06 | 0.000 | 0.00 | 0.286 | 0.048 | 0.0043 | 0.0004 | 0.49713 | 12.5 | 2.7 | 27.9 | 2.3 | 255.7 | 37.6 |
| 184 | DGR3-133-2.8 | 0.14 | 0.000 | 0.00 | 0.096 | 0.013 | 0.0019 | 0.0001 | 0.45902 | 7.5 | 0.8 | 12.5 | 0.8 | 93.3 | 12.1 |
| 185 | DGR3-133-2.9 | 0.05 | 0.000 | 0.00 | 0.111 | 0.030 | 0.0033 | 0.0004 | 0.40630 | 16.0 | 2.4 | 21.3 | 2.4 | 106.9 | 27.4 |
| 186 | DGR3-133-2.10 | 0.10 | 0.000 | 0.00 | 0.146 | 0.016 | 0.0027 | 0.0001 | 0.47213 | 9.5 | 1.0 | 17.2 | 0.9 | 138.7 | 14.4 |
| 187 | DGR3-133-6.2 | 0.01 | 0.000 | 0.00 | 2.509 | 0.592 | 0.0229 | 0.0030 | 0.56515 | 6.3 | 25.9 | 145.7 | 19.2 | 1274.7 | 161.4 |
| 188 | DGR3-133-6.3 | 0.04 | 0.000 | 0.00 | 0.417 | 0.069 | 0.0051 | 0.0004 | 0.52405 | 9.8 | 3.6 | 32.7 | 2.8 | 354.1 | 48.7 |
| 189 | DGR3-133-6.4 | 0.10 | 0.000 | 0.00 | 0.367 | 0.047 | 0.0038 | 0.0003 | 0.54167 | 4.2 | 2.4 | 24.6 | 1.7 | 317.7 | 34.2 |

| | Spot | U (ppm) | Pb206 (ppm) | Th/U | 207Pb/235U | 1 Sig | 206Pb/238U | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | 206Pb/238U Age (Ma) | 1 Sig | 207Pb/235U Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | DGR3-133-6.6 | 0.02 | 0.000 | 0.00 | 0.994 | 0.174 | 0.0107 | 0.0010 | 0.54129 | 13.6 | 8.8 | 68.5 | 6.4 | 700.5 | 85.7 |
| 191 | DGR3-133-4.2 | 0.54 | 0.001 | 0.00 | 0.018 | 0.003 | 0.0019 | 0.0001 | 0.24239 | 12.2 | 0.5 | 12.5 | 0.5 | 17.8 | 2.7 |
| 192 | DGR3-133-4.3 | 0.31 | 0.000 | 0.00 | 0.056 | 0.008 | 0.0016 | 0.0001 | 0.41434 | 7.4 | 0.6 | 10.1 | 0.6 | 55.3 | 7.2 |
| 193 | DGR3-133-4.5 | 0.07 | 0.000 | 0.00 | 0.161 | 0.035 | 0.0020 | 0.0002 | 0.51847 | 4.3 | 1.8 | 13.1 | 1.5 | 151.9 | 29.9 |
| 194 | DGR3-133-4.9 | 0.07 | 0.000 | 0.00 | 0.075 | 0.022 | 0.0033 | 0.0003 | 0.35346 | 18.0 | 2.2 | 21.2 | 2.2 | 73.4 | 20.2 |
| | ***DGR-3-162.07*** | ***Silurian Bass Islands Fm*** | | | | | | | | | | | | | |
| | ***May11-15a*** | ***213 nm M150510*** | | | | | | | | | | | | | |
| 195 | DGR-3-162.07-gr5.3 | 0.01 | 0.023 | 0.70 | 63.193 | 7.255 | 1.8299 | 0.1617 | 0.76988 | 0.0 | 0.0 | 6706 | 358 | 4226.0 | 110.0 |
| 196 | DGR-3-162.07-gr2.2 | 0.04 | 0.019 | 0.08 | 7.471 | 0.630 | 0.4355 | 0.0163 | 0.44345 | 0.0 | 0.0 | 2331.0 | 73.0 | 2170.0 | 73.0 |
| | ***DGR-3-180.06*** | ***Silurian Bass Islands Fm*** | | | | | | | | | | | | | |
| | ***May8-15b M150508*** | ***213nm*** | | | | | | | | | | | | | |
| 197 | DGR-3-180-gr1.1 | 0.13 | 0.003 | 0.07 | 2.569 | 0.208 | 0.0254 | 0.0011 | 0.51946 | 20.5 | 10.6 | 162.0 | 6.7 | 1291.7 | 57.9 |
| 198 | DGR-3-180-gr1.2 | 0.23 | 0.002 | 0.00 | 0.961 | 0.074 | 0.0103 | 0.0004 | 0.49672 | 12.8 | 3.9 | 65.9 | 2.5 | 683.6 | 37.9 |
| 199 | DGR-3-180-gr2.1 | 0.06 | 0.002 | 0.00 | 3.129 | 0.275 | 0.0334 | 0.0015 | 0.51685 | 40.9 | 14.1 | 211.5 | 9.4 | 1439.8 | 65.9 |
| 200 | DGR-3-180-gr3.1 | 0.04 | 0.022 | 0.05 | 8.397 | 0.432 | 0.5249 | 0.0123 | 0.45596 | 0.0 | 0.0 | 2720.0 | 51.8 | 2274.8 | 45.8 |
| 201 | DGR-3-180-gr4.1 | 4.73 | 0.016 | 0.54 | 0.078 | 0.003 | 0.0034 | 0.0000 | 0.30284 | 18.8 | 0.3 | 22.2 | 0.3 | 76.1 | 3.3 |
| 202 | DGR-3-180-gr4.2 | 1.47 | 0.005 | 0.02 | 0.127 | 0.008 | 0.0035 | 0.0001 | 0.36383 | 16.2 | 0.6 | 22.4 | 0.5 | 121.2 | 6.8 |
| 203 | DGR-3-180-gr5.1 | 0.04 | 0.002 | 0.01 | 5.847 | 0.466 | 0.0541 | 0.0024 | 0.55131 | 20.2 | 22.8 | 339.4 | 14.5 | 1953.4 | 67.5 |
| 204 | DGR-3-180-gr5.2 | 0.05 | 0.002 | 0.02 | 2.864 | 0.418 | 0.0305 | 0.0023 | 0.51468 | 37.0 | 21.5 | 193.4 | 14.3 | 1372.6 | 105.5 |
| 205 | DGR-3-180-gr5.3 | 0.05 | 0.001 | 0.01 | 3.641 | 0.312 | 0.0293 | 0.0014 | 0.54858 | -14.5 | 13.4 | 186.4 | 8.6 | 1558.6 | 66.7 |
| 206 | DGR-3-180-gr6.1 | 0.07 | 0.003 | 0.21 | 4.254 | 0.299 | 0.0435 | 0.0016 | 0.53016 | 43.0 | 15.1 | 274.4 | 10.0 | 1684.5 | 56.6 |
| 207 | DGR-3-180-gr6.2 | 0.05 | 0.001 | 0.04 | 1.956 | 0.191 | 0.0193 | 0.0010 | 0.51459 | 15.1 | 9.8 | 123.2 | 6.1 | 1100.4 | 64.1 |
| | ***DGR-3-186.43*** | ***Silurian Bass Islands Fm*** | | | | | | | | | | | | | |
| | ***Apr10-15a*** | ***213 nm*** | | | | | | | | | | | | | |
| 208 | DGR-3-186-gr4.1 | 3.41 | 0.007 | 0.00 | 0.122 | 0.006 | 0.0020 | 0.0000 | 0.33758 | 6.5 | 0.3 | 13.0 | 0.2 | 117.0 | 5.1 |
| 209 | DGR-3-186-gr4.2 | 4.01 | 0.007 | 0.00 | 0.085 | 0.004 | 0.0019 | 0.0000 | 0.30214 | 7.7 | 0.3 | 12.0 | 0.2 | 83.0 | 4.2 |
| 210 | DGR-3-186-gr3.1 | 4.53 | 0.010 | 0.00 | 0.129 | 0.007 | 0.0022 | 0.0000 | 0.33517 | 7.3 | 0.4 | 14.1 | 0.2 | 123.6 | 6.0 |
| 211 | DGR-3-186-gr3.2 | 0.21 | 0.002 | 0.00 | 0.988 | 0.096 | 0.0106 | 0.0004 | 0.40268 | 13.1 | 5.3 | 67.7 | 2.6 | 697.5 | 48.0 |
| 212 | DGR-3-186-gr1.1 | 3.31 | 0.007 | 0.00 | 0.068 | 0.005 | 0.0020 | 0.0000 | 0.26737 | 9.7 | 0.4 | 12.9 | 0.3 | 66.9 | 5.1 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Apr12-15a*** | ***213 nm*** | | | | | | | | | | | | | |
| 213 | DGR-3-186-gr2.1 | 1.93 | 0.003 | 0.00 | 0.058 | 0.003 | 0.0016 | 0.0000 | 0.27699 | 7.3 | 0.2 | 10.2 | 0.2 | 57.3 | 3.2 |
| 214 | DGR-3-186-gr2.2 | 2.03 | 0.003 | 0.00 | 0.054 | 0.004 | 0.0014 | 0.0000 | 0.27808 | 6.6 | 0.2 | 9.3 | 0.2 | 53.4 | 3.4 |
| 215 | DGR-3-186-gr3.1 | 1.14 | 0.003 | 0.00 | 0.147 | 0.008 | 0.0026 | 0.0000 | 0.32972 | 8.7 | 0.5 | 16.5 | 0.3 | 139.2 | 7.2 |
| 216 | DGR-3-186-gr3.2 | 1.82 | 0.003 | 0.00 | 0.077 | 0.004 | 0.0018 | 0.0000 | 0.29012 | 7.9 | 0.3 | 11.8 | 0.2 | 75.5 | 4.2 |
| 217 | DGR-3-186-gr4.3 | 3.62 | 0.005 | 0.00 | 0.036 | 0.002 | 0.0015 | 0.0000 | 0.22836 | 8.2 | 0.2 | 9.8 | 0.1 | 35.9 | 2.2 |
| 218 | DGR-3-186-gr5.1 | 0.09 | 0.001 | 0.00 | 1.353 | 0.108 | 0.0127 | 0.0004 | 0.42296 | 6.1 | 5.8 | 81.4 | 2.7 | 868.8 | 45.8 |
| 219 | DGR-3-186-gr5.2 | 0.25 | 0.003 | 0.00 | 1.041 | 0.056 | 0.0106 | 0.0002 | 0.41148 | 10.0 | 3.1 | 67.7 | 1.5 | 724.2 | 27.7 |
| 220 | DGR-3-186-gr5.3 | 3.28 | 0.006 | 0.00 | 0.061 | 0.004 | 0.0018 | 0.0000 | 0.27053 | 8.5 | 0.3 | 11.5 | 0.2 | 60.5 | 3.8 |
| 221 | DGR-3-186-gr6.1 | 1.97 | 0.004 | 0.00 | 0.105 | 0.007 | 0.0019 | 0.0000 | 0.32626 | 6.9 | 0.4 | 12.4 | 0.3 | 101.4 | 6.5 |
| 222 | DGR-3-186-gr6.2 | 1.98 | 0.004 | 0.00 | 0.101 | 0.008 | 0.0020 | 0.0000 | 0.31624 | 7.6 | 0.5 | 12.9 | 0.3 | 98.0 | 6.9 |
| 223 | DGR-3-186-gr6.3 | 1.01 | 0.002 | 0.00 | 0.108 | 0.008 | 0.0019 | 0.0000 | 0.32827 | 6.7 | 0.5 | 12.4 | 0.3 | 103.9 | 7.5 |
| | ***Apr24-15a LA150422*** | ***213 nm*** | | | | | | | | | | | | | |
| 224 | DGR-3-186-1.1 | 0.70 | 0.004 | 0.00 | 0.561 | 0.031 | 0.0060 | 0.0001 | 0.39872 | 7.8 | 1.7 | 38.9 | 0.9 | 452.2 | 20.2 |
| 225 | DGR-3-186-1.2 | 0.83 | 0.004 | 0.00 | 0.342 | 0.020 | 0.0044 | 0.0001 | 0.37241 | 10.0 | 1.1 | 28.6 | 0.6 | 298.6 | 14.9 |
| 226 | DGR-3-186-1.3 | 0.70 | 0.003 | 0.00 | 0.339 | 0.026 | 0.0042 | 0.0001 | 0.37959 | 8.2 | 1.5 | 26.8 | 0.8 | 296.5 | 19.8 |
| 227 | DGR-3-186-1.4 | 3.14 | 0.006 | 0.00 | 0.073 | 0.006 | 0.0018 | 0.0000 | 0.29015 | 7.8 | 0.4 | 11.5 | 0.3 | 71.9 | 5.7 |
| | ***Apr24-15b LA150422*** | ***213 nm*** | | | | | | | | | | | | | |
| 228 | DGR-3-186-3.1 | 0.23 | 0.012 | 0.00 | 5.733 | 0.158 | 0.0532 | 0.0007 | 0.44553 | 21.3 | 8.4 | 334.2 | 4.0 | 1936.3 | 23.6 |
| 229 | DGR-3-186-3.2 | 0.24 | 0.002 | 0.00 | 0.681 | 0.054 | 0.0073 | 0.0002 | 0.39949 | 9.2 | 3.0 | 46.9 | 1.5 | 527.3 | 32.1 |
| 230 | DGR-3-186-3.3 | 0.79 | 0.003 | 0.00 | 0.331 | 0.023 | 0.0039 | 0.0001 | 0.38386 | 7.0 | 1.3 | 25.2 | 0.7 | 290.5 | 17.2 |
| 231 | DGR-3-186-3.4 | 3.19 | 0.009 | 0.00 | 0.122 | 0.006 | 0.0027 | 0.0000 | 0.30194 | 11.1 | 0.4 | 17.3 | 0.3 | 116.8 | 5.3 |
| 232 | DGR-3-186-2.1 | 0.57 | 0.009 | 0.00 | 1.570 | 0.048 | 0.0152 | 0.0002 | 0.41763 | 10.3 | 2.6 | 97.4 | 1.2 | 958.5 | 18.8 |
| 233 | DGR-3-186-2.2 | 0.43 | 0.004 | 0.00 | 0.910 | 0.043 | 0.0101 | 0.0002 | 0.39621 | 14.6 | 2.3 | 64.8 | 1.2 | 657.3 | 22.4 |
| 234 | DGR-3-186-5.1 | 1.58 | 0.005 | 0.00 | 0.210 | 0.016 | 0.0029 | 0.0001 | 0.36006 | 7.6 | 0.9 | 18.9 | 0.5 | 193.1 | 13.4 |
| 235 | DGR-3-186-5.2 | 0.33 | 0.005 | 0.00 | 1.901 | 0.115 | 0.0167 | 0.0004 | 0.43168 | 0.8 | 5.4 | 107.0 | 2.8 | 1081.6 | 39.7 |
| 236 | DGR-3-186-5.3 | 0.46 | 0.004 | 0.00 | 0.919 | 0.042 | 0.0098 | 0.0002 | 0.40204 | 11.8 | 2.3 | 62.6 | 1.2 | 661.9 | 22.3 |
| 237 | DGR-3-186-6.1 | 1.87 | 0.006 | 0.00 | 0.256 | 0.020 | 0.0033 | 0.0001 | 0.37035 | 7.5 | 1.1 | 21.5 | 0.6 | 231.4 | 15.7 |
| 238 | DGR-3-186-7.1 | 1.80 | 0.004 | 0.00 | 0.159 | 0.008 | 0.0025 | 0.0000 | 0.34625 | 7.5 | 0.5 | 16.0 | 0.3 | 149.6 | 7.1 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 239 | DGR-3-186-7.2 | 2.66 | 0.006 | 0.00 | 0.112 | 0.006 | 0.0021 | 0.0000 | 0.32346 | 7.5 | 0.4 | 13.4 | 0.2 | 107.4 | 5.4 |
| 240 | DGR-3-186-7.3 | 8.67 | 0.012 | 0.00 | 0.029 | 0.002 | 0.0014 | 0.0000 | 0.21965 | 7.5 | 0.1 | 8.7 | 0.1 | 29.4 | 1.5 |
| | ***Apr12-15b LA150409*** | ***213 nm*** | | | | | | | | | | | | | |
| 241 | DGR-3-186-gr2.1 | 3.04 | 0.005 | 0.00 | 0.083 | 0.004 | 0.0018 | 0.0000 | 0.30468 | 7.2 | 0.3 | 11.5 | 0.2 | 81.2 | 3.8 |
| 242 | DGR-3-186-gr2.2 | 2.20 | 0.004 | 0.00 | 0.093 | 0.006 | 0.0018 | 0.0000 | 0.31424 | 7.1 | 0.4 | 11.9 | 0.2 | 90.5 | 5.3 |
| 243 | DGR-3-186-gr2.3 | 3.45 | 0.006 | 0.00 | 0.073 | 0.004 | 0.0018 | 0.0000 | 0.29063 | 7.6 | 0.3 | 11.3 | 0.2 | 71.6 | 4.1 |
| | ***Jun24-15a*** | ***193 nm*** | | | | | | | | | | | | | |
| 244 | DGR3-186-6.1 | 0.19 | 0.000 | 0.00 | 0.080 | 0.007 | 0.0017 | 0.0001 | 0.45045 | 7.0 | 0.5 | 11.1 | 0.5 | 78.3 | 6.8 |
| 245 | DGR3-186-6.2 | 0.31 | 0.001 | 0.00 | 0.085 | 0.007 | 0.0020 | 0.0001 | 0.44052 | 8.4 | 0.5 | 12.7 | 0.4 | 82.7 | 6.2 |
| 246 | DGR3-186-6.3 | 0.13 | 0.000 | 0.00 | 0.285 | 0.020 | 0.0037 | 0.0001 | 0.51527 | 8.5 | 1.1 | 24.1 | 0.9 | 254.9 | 15.9 |
| 247 | DGR3-186-6.4 | 0.07 | 0.000 | 0.00 | 0.502 | 0.038 | 0.0055 | 0.0002 | 0.53823 | 7.2 | 1.9 | 35.0 | 1.4 | 413.3 | 25.6 |
| 248 | DGR3-186-6.5 | 0.81 | 0.001 | 0.00 | 0.064 | 0.005 | 0.0017 | 0.0000 | 0.42491 | 7.5 | 0.3 | 10.7 | 0.3 | 62.8 | 4.3 |
| 249 | DGR3-186-6.6 | 0.17 | 0.001 | 0.00 | 0.298 | 0.021 | 0.0041 | 0.0001 | 0.50785 | 10.5 | 1.1 | 26.7 | 0.9 | 264.6 | 16.2 |
| 250 | DGR3-186-6.7 | 0.04 | 0.000 | 0.00 | 0.697 | 0.056 | 0.0069 | 0.0003 | 0.54887 | 5.6 | 2.8 | 44.4 | 1.9 | 537.1 | 33.1 |
| 251 | DGR3-186-6.8 | 0.71 | 0.001 | 0.00 | 0.054 | 0.003 | 0.0017 | 0.0000 | 0.39992 | 8.2 | 0.3 | 10.8 | 0.2 | 53.0 | 3.0 |
| 252 | DGR3-186-6.9 | 0.05 | 0.000 | 0.00 | 0.734 | 0.060 | 0.0073 | 0.0003 | 0.54845 | 6.2 | 3.0 | 47.0 | 2.1 | 559.2 | 34.5 |
| 253 | DGR3-186-6.10 | 1.23 | 0.002 | 0.00 | 0.025 | 0.001 | 0.0014 | 0.0000 | 0.32091 | 8.1 | 0.2 | 9.0 | 0.2 | 24.8 | 1.4 |
| 254 | DGR3-186-6.11 | 0.55 | 0.001 | 0.00 | 0.054 | 0.003 | 0.0016 | 0.0000 | 0.40427 | 7.9 | 0.2 | 10.5 | 0.2 | 53.2 | 2.9 |
| 255 | DGR3-186-6.12 | 1.32 | 0.002 | 0.00 | 0.037 | 0.002 | 0.0015 | 0.0000 | 0.36699 | 7.8 | 0.2 | 9.4 | 0.2 | 36.6 | 1.7 |
| 256 | DGR3-186-6.13 | 0.06 | 0.000 | 0.00 | 0.485 | 0.036 | 0.0057 | 0.0002 | 0.52876 | 10.1 | 1.8 | 36.8 | 1.4 | 401.2 | 24.2 |
| 257 | DGR3-186-3.1 | 0.34 | 0.001 | 0.00 | 0.114 | 0.007 | 0.0022 | 0.0001 | 0.46491 | 8.3 | 0.4 | 14.2 | 0.4 | 109.9 | 6.3 |
| 258 | DGR3-186-3.2 | 0.05 | 0.000 | 0.00 | 0.706 | 0.049 | 0.0075 | 0.0003 | 0.54076 | 9.4 | 2.5 | 48.5 | 1.8 | 542.2 | 28.7 |
| 259 | DGR3-186-3.3 | 0.31 | 0.001 | 0.00 | 0.127 | 0.007 | 0.0023 | 0.0001 | 0.47168 | 8.4 | 0.4 | 15.1 | 0.4 | 121.8 | 6.4 |
| 260 | DGR3-186-3.4 | 0.60 | 0.001 | 0.00 | 0.060 | 0.004 | 0.0017 | 0.0001 | 0.41307 | 8.0 | 0.3 | 11.0 | 0.3 | 59.2 | 4.1 |
| 261 | DGR3-186-3.5 | 0.06 | 0.002 | 0.00 | 3.508 | 0.102 | 0.0320 | 0.0005 | 0.56955 | 9.4 | 5.0 | 203.3 | 3.3 | 1529.0 | 22.8 |
| 262 | DGR3-186-3.6 | 0.12 | 0.001 | 0.00 | 0.368 | 0.021 | 0.0046 | 0.0001 | 0.52219 | 9.2 | 1.1 | 29.3 | 0.9 | 317.9 | 15.4 |
| 263 | DGR3-186-3.7 | 0.59 | 0.001 | 0.00 | 0.069 | 0.004 | 0.0018 | 0.0000 | 0.42661 | 7.9 | 0.3 | 11.4 | 0.3 | 67.4 | 3.5 |
| | ***DGR-4-344.18*** | ***Silurian Salina A1 Unit*** | | | | | | | | | | | | | |
| | ***May12-15a M150510*** | ***213 nm*** | | | | | | | | | | | | | |
| 264 | DGR-4-344.18-gr3.1 | 2.67 | 0.529 | 0.40 | 17.822 | 0.203 | 0.1980 | 0.0014 | 0.61274 | 284.4 | 9.5 | 1164.6 | 7.4 | 2980.2 | 10.9 |

| | Spot | U (ppm) | $Pb^{206}$ (ppm) | Th/U | $^{207}Pb/^{235}U$ | 1 Sig | $^{206}Pb/^{238}U$ | 1 Sig | Error Correl. | Model Age (Ma) | 1 Sig | $^{206}Pb/^{238}U$ Age (Ma) | 1 Sig | $^{207}Pb/^{235}U$ Age (Ma) | 1 Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 265 | DGR-4-344.18-gr3.3 | 4.01 | 0.693 | 0.05 | 14.976 | 0.083 | 0.1726 | 0.0006 | 0.60310 | 276.7 | 4.6 | 1022.8 | 3.7 | 2813.5 | 6.1 |
| 266 | DGR-4-344.18-gr4.1 | 0.65 | 0.018 | 0.15 | 0.690 | 0.029 | 0.0282 | 0.0004 | 0.32892 | 119.5 | 3.2 | 134.3 | 3.0 | 335.7 | 22.3 |
| | ***May13-15a M150510*** | ***213 nm*** | | | | | | | | | | | | | |
| 267 | DGR-4-344.18-gr4.2 | 0.35 | 0.018 | 0.43 | 0.711 | 0.037 | 0.0522 | 0.0007 | 0.27018 | 309.2 | 4.8 | 328.3 | 4.5 | 545.4 | 21.8 |
| 268 | DGR-4-344.18-gr4.3 | 0.87 | 0.031 | 0.28 | 0.706 | 0.051 | 0.0360 | 0.0008 | 0.30523 | 201.7 | 5.2 | 228.2 | 4.9 | 542.2 | 29.7 |
| 269 | DGR-4-344.18-gr4.4 | 0.19 | 0.010 | 0.34 | 0.915 | 0.066 | 0.0544 | 0.0012 | 0.29661 | 311.9 | 7.5 | 341.6 | 7.1 | 659.6 | 34.5 |
| 270 | DGR-4-344.18-gr4.5 | 0.74 | 0.027 | 0.20 | 1.103 | 0.040 | 0.0373 | 0.0005 | 0.36184 | 186.6 | 3.2 | 235.8 | 3.0 | 754.9 | 18.9 |
| 271 | DGR-4-344.18-gr4.6 | 1.36 | 0.033 | 0.17 | 0.446 | 0.024 | 0.0242 | 0.0004 | 0.29182 | 137.2 | 2.6 | 153.8 | 2.4 | 374.6 | 17.0 |
| 272 | DGR-4-344.18-gr4.7 | 1.01 | 0.053 | 0.30 | 0.483 | 0.020 | 0.0527 | 0.0005 | 0.22925 | 325.4 | 3.2 | 331.0 | 3.0 | 400.0 | 13.5 |
| 273 | DGR-4-344.18-gr4.8 | 0.47 | 0.024 | 0.33 | 0.501 | 0.029 | 0.0513 | 0.0007 | 0.23290 | 314.8 | 4.5 | 322.2 | 4.2 | 412.3 | 19.5 |
| 274 | DGR-4-344.18-gr4.9 | 1.68 | 0.118 | 0.14 | 3.121 | 0.152 | 0.0703 | 0.0015 | 0.43934 | 289.6 | 10.0 | 438.2 | 9.0 | 1438.0 | 36.9 |

**FOOTNOTES TO APPENDIX A2**

All analyses carried out using the NIST610 standard

Error Correl. - Error correlation coefficient for concordia coordinates

Relation between ages and concordia coordinates: Y = 206Pb/238U = EXP(L238*(206-238Age)) - 1;

X = 207Pb/235U = EXP(L235*(207-235Age)) - 1

207Pb/206Pb = 137.88*X/Y; U decay constants (L238 & L235) from Jaffey et al. (1971).

## APPENDIX A3: SUMMARY OF ID-TIMS U-Pb ISOTOPIC ANALYSES ON VEIN CALCITE

| No. | Sample | Comments* | Wt. (mg) | U (ppb) | $^{238}U/^{204}Pb$ | Pbtot (pg) | $\%Pb^{206}$ Com | $^{206}Pb/^{204}Pb$ | 2 Sig | $^{207}Pb/^{204}Pb$ | 2 Sig | Rho76 | $^{206}Pb/^{238}U$ Age(Ma) | 2 Sig | $^{207}Pb/^{235}U$ Age(Ma) | 2 Sig | RhoC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **DD12-11NE Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 1 | amt-1 | outer half | 2.0 | 0.27 | 3413 | 16.9 | 36.4 | 66.38 | 16.55 | 17.79 | 0.78 | 0.9725 | 89.5 | 1.5 | 85.1 | 24.8 | 0.08615 |
| 2 | amt-2 | inner half | 2.0 | 0.32 | 4989 | 16.5 | 28.3 | 89.80 | 31.62 | 18.91 | 1.48 | 0.9880 | 91.3 | 1.1 | 88.1 | 17.3 | 0.13004 |
| 3 | dwd5916A** | Grain 6, 80 Ma | 1*** | 0.56 | 16736 | 9 | 11 | 253.5 | 142.5 | 26.60 | 6.71 | 0.9965 | 89.9 | 0.5 | 87.9 | 6.6 | 0.41316 |
| 4 | dwd5916B** | Grain 6, 80 Ma | 1*** | 0.57 | 8856 | 11 | 19 | 142.81 | 80.82 | 21.32 | 3.73 | 0.9962 | 89.9 | 0.6 | 86.4 | 10.4 | 0.23108 |
| 5 | dwd5914 | Grain 2, 86 Ma | 1*** | 0.71 | 2740 | 26 | 35 | 59.42 | 5.28 | 17.62 | 0.29 | 0.9268 | 95.6 | 1.8 | 97.3 | 29.7 | 0.03369 |
| 6 | dwd5917 | Grain 12, 60 Ma | 1*** | 0.39 | 1562 | 21 | 53 | 39.28 | 2.81 | 16.68 | 0.22 | 0.7455 | 85.1 | 3.1 | 90.9 | 53.3 | 0.05663 |
| | **DD12-12SE Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 7 | amt-3 | outer half | 4.4 | 0.12 | 413 | 84.2 | 86.7 | 22.34 | 0.16 | 15.71 | 0.05 | 0.4015 | -- | -- | -- | -- | -- |
| 8 | amt-4 | inner half | 4.4 | 0.12 | 1050 | 73.0 | 18.8 | 108.78 | 8.76 | 19.65 | 0.40 | 0.9817 | 530.7 | 4.5 | 430.8 | 55.7 | 0.02445 |
| | **DD12-12FV Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 9 | dwd5911 | Grain 16, 78 Ma | 1*** | 0.42 | 1064 | 31 | 59 | 33.91 | 1.29 | 16.35 | 0.10 | 0.6973 | 92.5 | 4.5 | 92.2 | 77.0 | 0.01364 |
| 10 | dwd5913 | Grain 2, 60 Ma | 1*** | 1.30 | 2553 | 43 | 51 | 38.60 | 1.26 | 16.55 | 0.09 | 0.7436 | 50.5 | 1.9 | 49.9 | 33.0 | 0.00925 |
| | **DD12-13N Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 11 | amt-8 | outer third | 5.3 | 0.24 | 945 | 96.9 | 65.6 | 29.47 | 0.40 | 16.05 | 0.05 | 0.4567 | 73.2 | 5.1 | 60.4 | 89.5 | 0.00549 |
| 12 | amt-9 | middle third | 5.3 | 0.32 | 3567 | 48.5 | 32.3 | 63.62 | 4.73 | 17.57 | 0.22 | 0.9328 | 80.8 | 1.4 | 73.4 | 23.2 | 0.02030 |
| 13 | amt-10 | inner third | 5.3 | 0.32 | 2636 | 64.7 | 37.7 | 61.57 | 12.03 | 17.44 | 0.53 | 0.9583 | 104.1 | 1.9 | 91.9 | 31.5 | 0.06294 |
| | **DD12-16 Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 14 | amt-5 | outer third | 10.2 | 0.05 | 455 | 91.1 | 53.4 | 36.44 | 0.75 | 16.30 | 0.06 | 0.5809 | 246.9 | 10.3 | 188.1 | 167.1 | 0.00599 |
| 15 | amt-6 | middle third | 10.2 | 0.38 | 34328 | 55.4 | 8.8 | 508.12 | 2287 | 37.53 | 102 | 1.0000 | 91.4 | 0.4 | 85.6 | 4.0 | 0.48497 |
| 16 | amt-7 | inner third | 10.2 | 0.11 | 2646 | 37.6 | 37.9 | 55.08 | 4.55 | 17.06 | 0.20 | 0.9051 | 88.2 | 1.8 | 73.1 | 31.3 | 0.02153 |
| | **DGR3-034 Devonian Lucas Formation** | | | | | | | | | | | | | | | | |
| 17 | amt-11 | whole grain | 2.3 | 1.12 | 2567 | 88.4 | 44.9 | 48.20 | 5.18 | 17.03 | 0.27 | 0.9218 | 73.8 | 1.9 | 73.7 | 32.5 | 0.03245 |
| 18 | dwd5953 | whole grain | 0.71 | 0.91 | 3448 | 19.6 | 31.3 | 64.79 | 4.08 | 17.74 | 0.21 | 0.9144 | 85.7 | 1.4 | 82.3 | 23.8 | 0.02229 |
| 19 | dwd5954 | outer half | 0.6 | 0.90 | 4555 | 13.7 | 27.5 | 77.04 | 8.37 | 18.39 | 0.43 | 0.9511 | 82.1 | 1.1 | 81.7 | 18.2 | 0.05147 |
| 20 | dwd5955 | inner half | 0.6 | 0.63 | 10619 | 7.6 | 14.8 | 181.32 | 91.33 | 22.96 | 4.13 | 0.9972 | 98.1 | 0.6 | 92.3 | 8.5 | 0.20982 |
| 21 | dwd5771 | slab fragment | 8.0 | 0.07 | 1304 | 38 | 47 | 40.66 | 0.81 | 16.85 | 0.08 | 0.6673 | 108.5 | 3.6 | 124.4 | 60.6 | 0.01158 |
| 22 | dwd5772 | slab fragment | 33.0 | 0.05 | 1469 | 91 | 50 | 37.68 | 0.28 | 16.65 | 0.04 | 0.5399 | 83.5 | 3.2 | 93.7 | 55.1 | 0.00401 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **DGR-1-113 Devonian Bois Blanc Formation** | | | | | | | | | | | | | | | |
| 23 | amt15 | outer half | 4.8 | 0.50 | 2555 | 44 | 84.9 | 22.16 | 0.23 | 15.81 | 0.14 | 0.8554 | 8.8 | 1.9 | 9.9 | 35.0 | 0.00300 |
| 24 | amt16 | inner half | 4.8 | 0.36 | 24442 | 16 | 11.5 | 226.4 | 119.4 | 24.37 | 5.04 | 0.9978 | 54.7 | 0.2 | 48.9 | 3.9 | 0.24332 |
| 25 | amt17 | outer third | 5.4 | 0.33 | 17640 | 10 | 39.5 | 56.30 | 14.22 | 16.86 | 0.67 | 0.7652 | 13.8 | 0.3 | 9.7 | 6.0 | 0.33386 |
| 26 | amt18 | inner two-thirds | 5.4 | 1.11 | 4374 | 140 | 33.7 | 56.01 | 0.89 | 17.16 | 0.07 | 0.6556 | 55.0 | 1.1 | 48.1 | 19.3 | 0.00949 |
| | **DGR-3-180 Silurian Bass Islands Fm** | | | | | | | | | | | | | | | | |
| 27 | amt19 | whole crystal | 1.8 | 0.33 | 1293 | 35 | 62.3 | 30.72 | 0.88 | 16.09 | 0.09 | 0.5125 | 59.9 | 3.7 | 48.8 | 66.1 | 0.01553 |
| | **DGR-3-186 Silurian Bass Islands Fm** | | | | | | | | | | | | | | | | |
| 28 | amt13 | outer half | 28.0 | 0.97 | 28732 | 97 | 30.7 | 62.27 | 1.50 | 16.94 | 0.07 | 0.7276 | 9.9 | 0.2 | 6.4 | 3.0 | 0.00759 |
| 29 | amt14 | inner half | 28.0 | 3.25 | 6964 | 1012 | 55.3 | 33.84 | 0.07 | 16.17 | 0.04 | 0.8517 | 14.1 | 0.7 | 10.9 | 12.5 | 0.00376 |
| | **DGR-4-344 Silurian Salina A1 Unit** | | | | | | | | | | | | | | | | |
| 30 | amt20 | whole crystal | 3.0 | 0.44 | 9379 | 78 | 4.6 | 485.0 | 117.1 | 40.57 | 6.27 | 0.9997 | 313.1 | 0.6 | 317.4 | 7.1 | 0.11423 |
| | **DGR-6-756-48B Ordovician** | | | | | | | | | | | | | | | | |
| 31 | dwd5777 | slab fragment | 1.4 | 0.08 | 118 | 67 | 69.7 | 27.1 | 0.2 | 16.14 | 0.05 | 0.5565 | 450.7 | 38.1 | 480.1 | 527.4 | 0.00529 |

**FOOTNOTES TO APPENDIX A3**

Pb-Pb and U-Pb ratios corrected for fractionation, blank and spike. U-Pb ratios also corrected for initial common Pb.

*Grain number refers to Table 1, followed by LA-ICPMS model age; ** splits of the same solution, *** not weighed, ca. 1 mg.

PbTot - common Pb assuming the isotopic composition of laboratory blank:(errors of 2%).

206/204 - 18.221; 207/204 - 15.612; 208/204 - 39.360

%Pb206 Com - Percent of total 206Pb that is initial common Pb.

Rho76 - Error correlation coefficient for Pb 207/204 vs. 206/204 coordinates

RhoC - Error correlation coefficient for concordia coordinates

Concordia coordinates: Y = 206Pb/238U = EXP(L238*(206-238 Age)) - 1; X = 207Pb/235U = EXP(L235*(207-235 Age)) - 1

207Pb/206Pb = 137.88*X/Y; Uranium decay constants (L238 & L235) are from Jaffey et al. (1971).