

Archiving new U-Pb data and re-use of legacy data

Issues:

- Lots (100,000's) of DZ ages published already
- Each data set is large (hundreds to thousands of analyses)
- Increasing number of data sets generated per year
- No existing database formatted appropriately for DZ data, with global coverage
- Need community agreement on data interpretation & reporting

Opportunities:

- Global database for DZ ages would be a powerful research tool!
- Provide platform for developing new tools for data analysis/interpretation

“Geochron” = Detrital Zircon Database in development

Jim Bowring = College of Charleston (Cirdles: programming)

Doug Walker & Jason Ash = University of Kansas (EarthChem)

Sam Bowring and Noah McLean = MIT (EARTHTIME)

George Gehrels & Clare Tochilin = University of Arizona (NU multicollector)

Geochronology Working Group (Matt Horstwood, Norm Pearson, Jan Kosler, Paul Sylvester, Jackson, Chad Paton)

Jeff Vervoort = Washington State University (Element Hi Res single-collector)

Tom Lapen = University of Houston (Varian quadrupole)

Funding from US National Science Foundation & ExxonMobil

Phase 1: Build database to handle legacy DZ data

Phase 2:

- Develop math for rigorous data reduction (EARTHTIME/Working-group protocols)
- Develop software for data reduction/analysis tools
- Enable labs to connect to Geochron for real-time reduction/analysis/archival
- Platform for developing new tools to display, analyze, and compare data sets

Geologic Metadata

Legacy Samples:

Sample name

Location (Lat/Long or UTM)

Source/publication Info

New Samples:

Sample name

IGSN(?) identifier

Location (Lat/Long or UTM & elevation)

Unit Name (e.g., Eureka Formation)

Rock Type (e.g., sandstone, conglomerate, quartzite)

Type of Analysis (Provenance, Max Depo Age, etc.)

Name of Collector

Source of Data (Publication info)

Stratigraphic age (Period/Epoch)

Minimum stratigraphic age (Ma)

Maximum stratigraphic age (Ma)

Size of sample

Sample notes

Name & Type of Physiographic Feature

Location Description

Locality (City, County, State, Country)

Field Program

Collection Date

Curation of Sample (current and original)

Analytical Data

Legacy Data:

Sample Name/Fraction

206/238 ratio and uncertainty

207/235 ratio and uncertainty

rho 206/238-207/235

206/238 age and uncertainty

207/235 age and uncertainty

206/207 age and uncertainty

Preferred age and uncertainty

206/204 and uncertainty

Concordance (%)

Uconc

U/Th

Submitted as xls (csv) file

New Data:

Sample info (4 cells)

Lab info (16 cells)

Constants (12 cells)

Blank Info (11 cells)

Initial Pb info (6 cells)

Standard Info (11 cells)

Analysis info (14 cells)

Counts and Ratios (48 cells)

Ages & Uncertainties (10 cells)

*Submitted automatically with
each analysis*

Keyed to unique GrainID

Host Rock Age: (Ma)

Min:

Max:

Detrital Rock Type:

NONE

or Geological Age

NONE

CENOZOIC (0 Ma - 65.5 Ma)

» QUATERNARY (0 Ma - 2.6 Ma)

» HOLOCENE (0 Ma - 0.01 Ma)

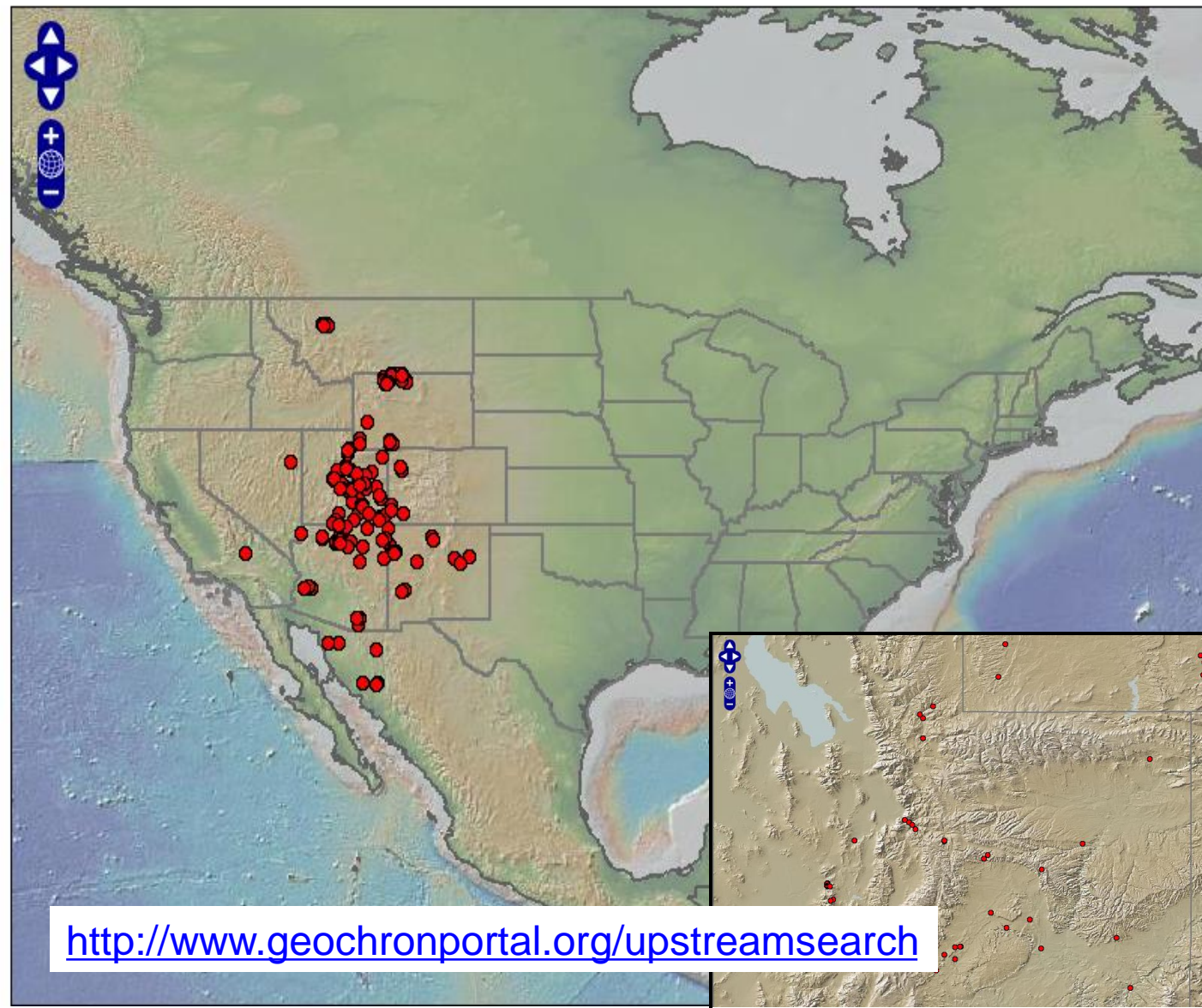
» PLEISTOCENE (0.01 Ma - 2.6 Ma)

Show:

☐ Show All Samples ☒ Show Only Filtered

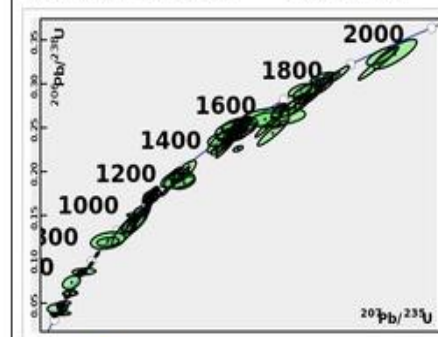
Figures:

☐ Show Concordia Diagrams ☒ Show points



Sample Details:

Sample ID:	Currie Chinle
Min Age:	201.6 Ma
Max Age:	235.0 Ma
Detrital Type:	sandstone
Stratigraphic Formation Name:	Shinarump
Oldest Frac. Date:	1977.192 Ma
Youngest Frac. Date:	222.346 Ma

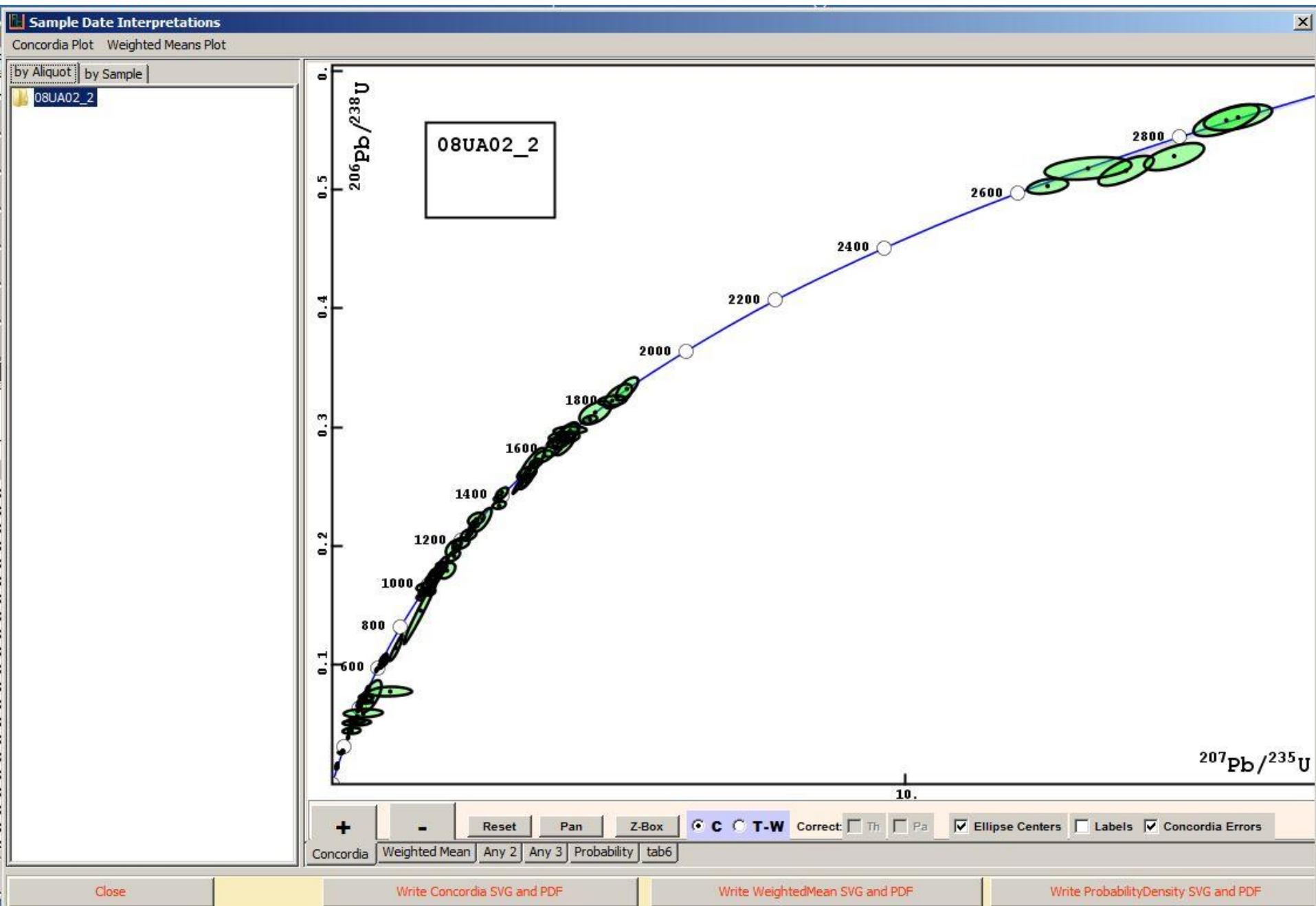


[VIEW SAMPLE DETAILS](#)

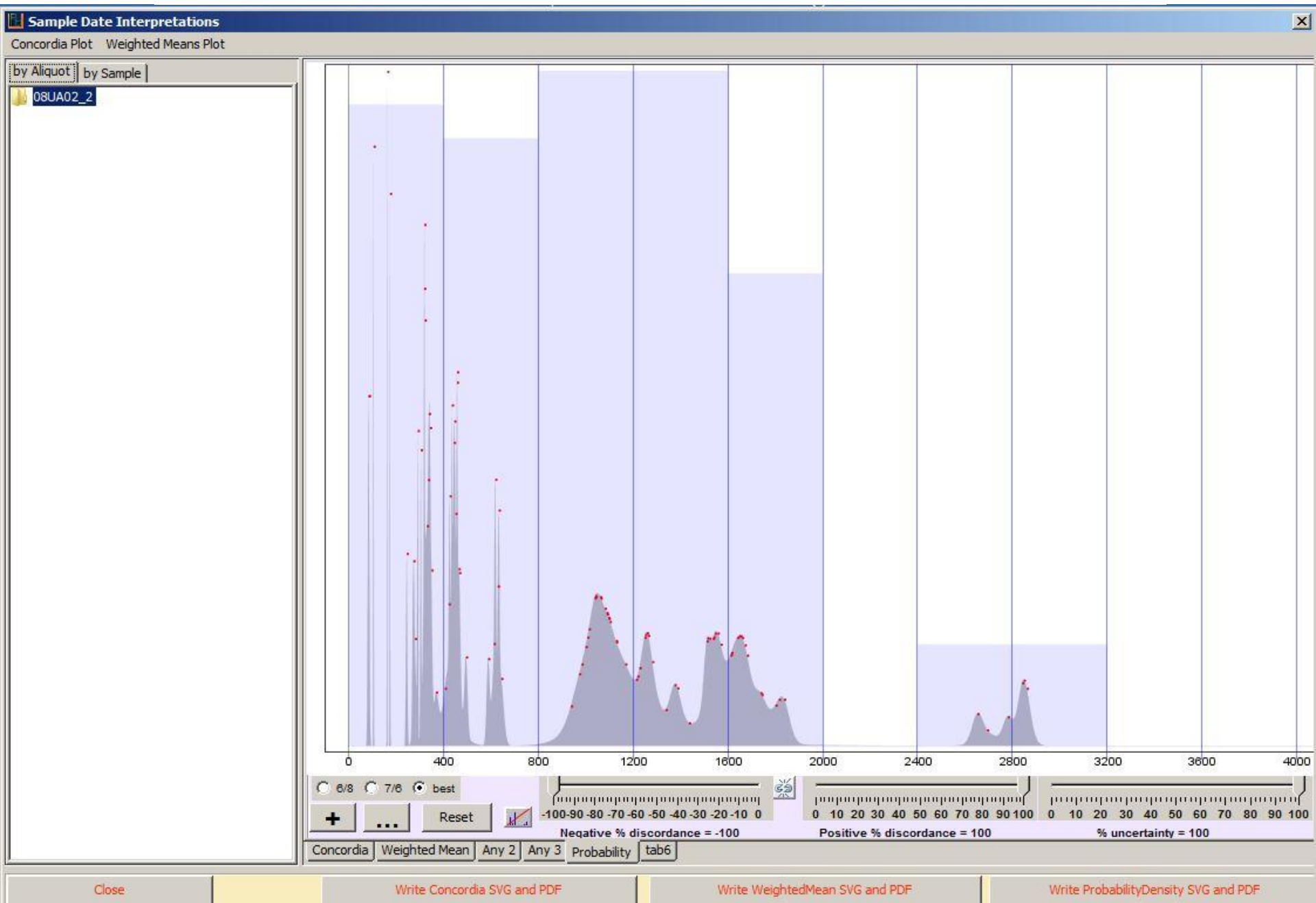
Total Sample Count: 245

<http://www.geochronportal.org/upstreamsearch>

Concordia Plot



Probability Plot

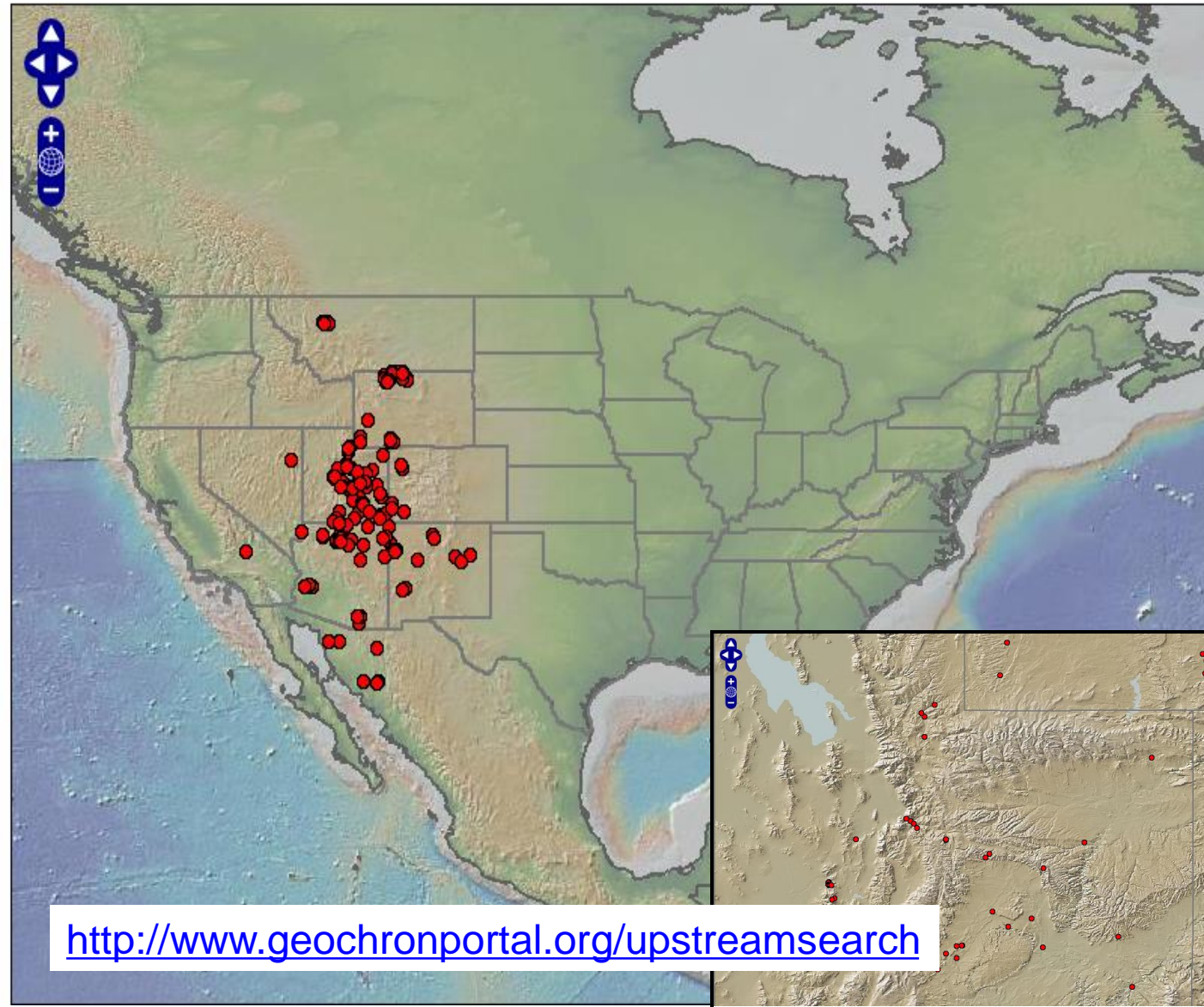


U-Pb Table (selectable)

</

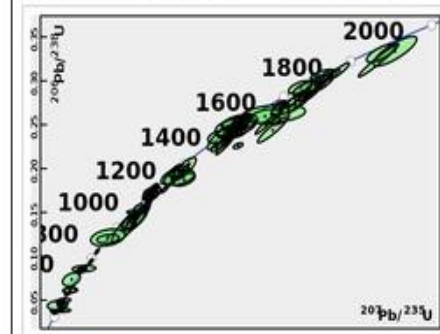
Database ready to go – anywhere in the world!

Contact Jim Bowring bowring@gmail.com



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Structure of Database for New Data

Database

Real world

PROJECT

Project (collection of samples)

SAMPLE

(will be many
per project)

Sample

(= chunk of rock)

ALIQUOT

(will be many
per sample)

**Zircon
Crystal**

**Apatite
Crystal**

**Feldspar
Crystal**

Other info from Sample
Geochemistry
Fossils, etc.

ANALYSIS

(will be many
per aliquot)
*Tracked by
GrainID*

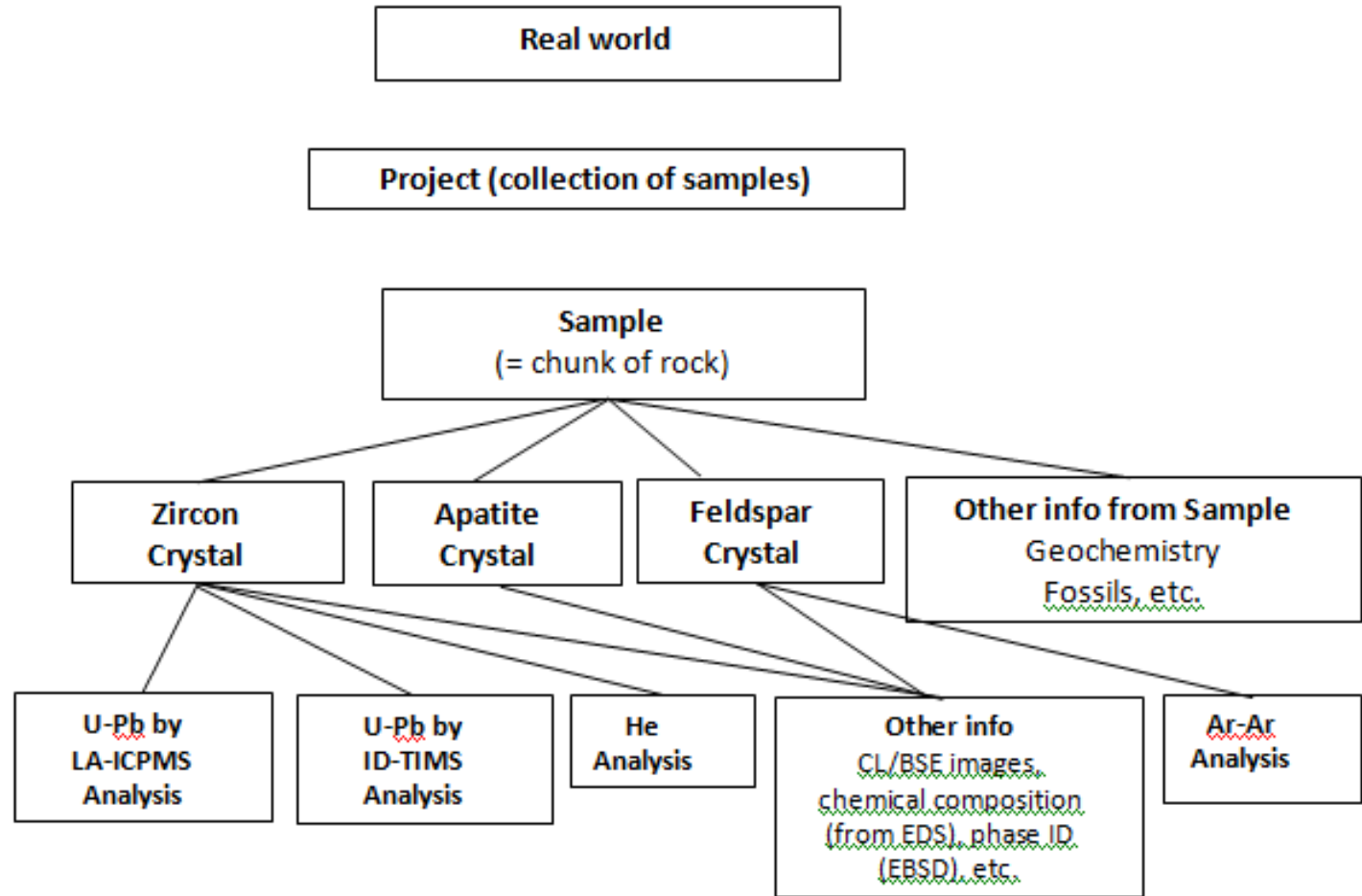
**U-Pb by
LA-ICPMS
Analysis**

**U-Pb by
ID-TIMS
Analysis**

**He
Analysis**

Other info
CL/BSE images,
chemical composition
(from EDS), phase ID
(EBSD), etc.

**Ar-Ar
Analysis**



Workflow for New data:

Mass spec feeds raw data directly to Geochron

- MIT-TIMS

- NU HR ICPMS (Arizona)

- Element HR Single-Collector (Jeff Vervoort)

- Varian Quadrupole (Tom Lapen)

Data matched in Geochron with Parameters/Protocols for specific lab

Data matched with geological metadata for sample

Operator evaluates intensities & ratios using graphical output (real-time)

Intensities & ratios used to calculate ages (real-time)

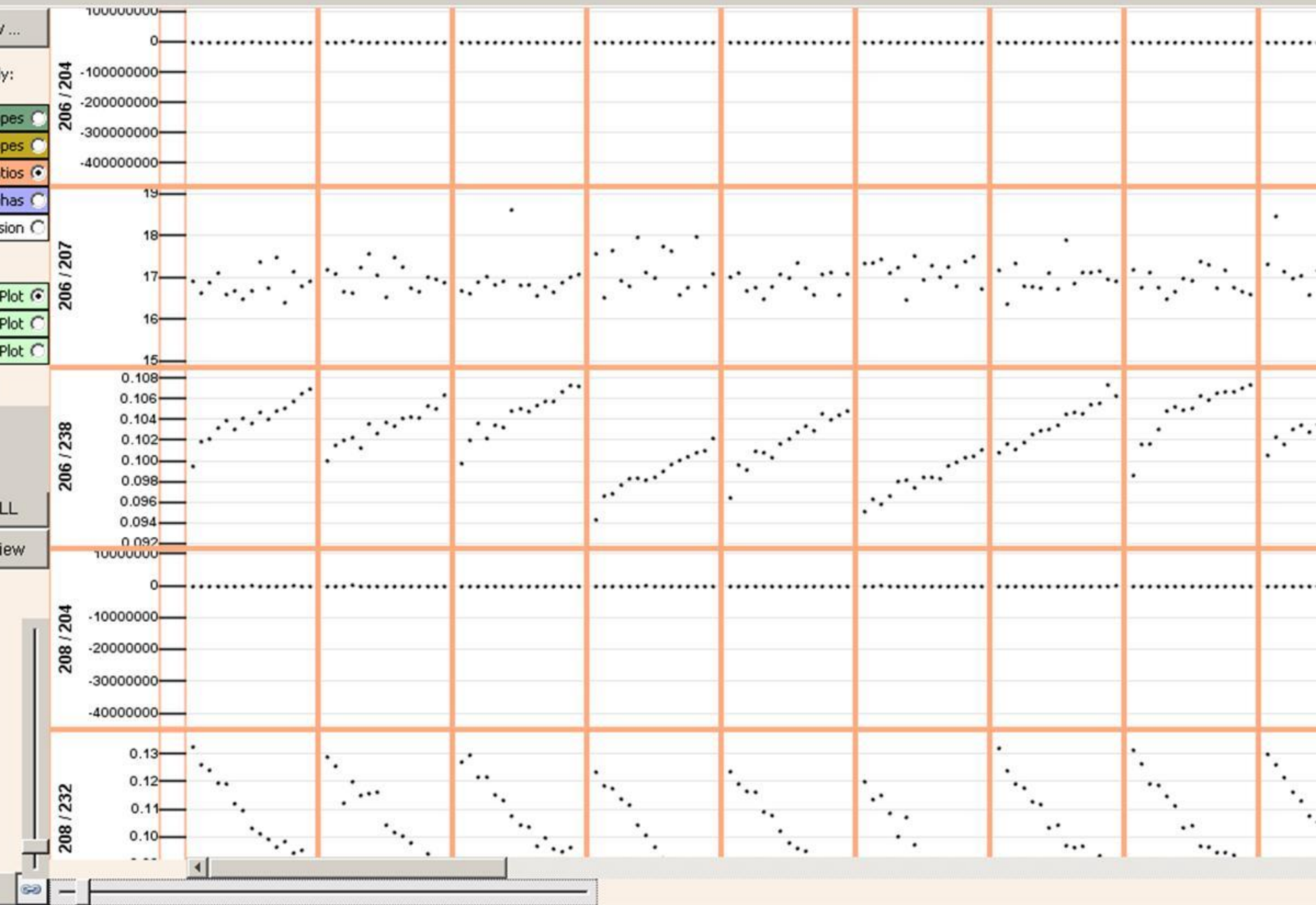
Concordia, Log-Concordia, & T-W Concordia plots updated real-time

Graphs and Tables can be saved (Publication quality)

Tools available for comparing with other samples and other types of data

- Probability Plots, Histograms, etc

Information remains private until released



Load Raw ...

Standard SL only:

Raw Isotopes ☐Corr Isotopes ☐Ratios ☐Alphas ☒Session ☐Grid Plot ☐Graph Plot ☐Overlay Plot ☒

Fractions View:

☒ ALL☐ INCLUDED☐ EXCLUDED

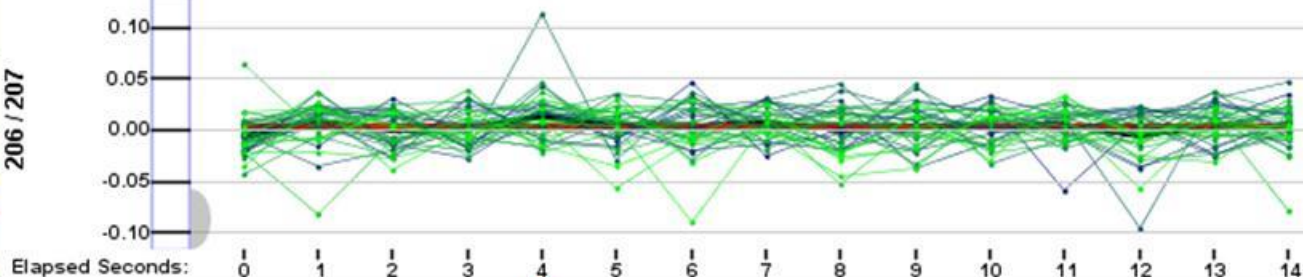
Include ALL

Refresh View

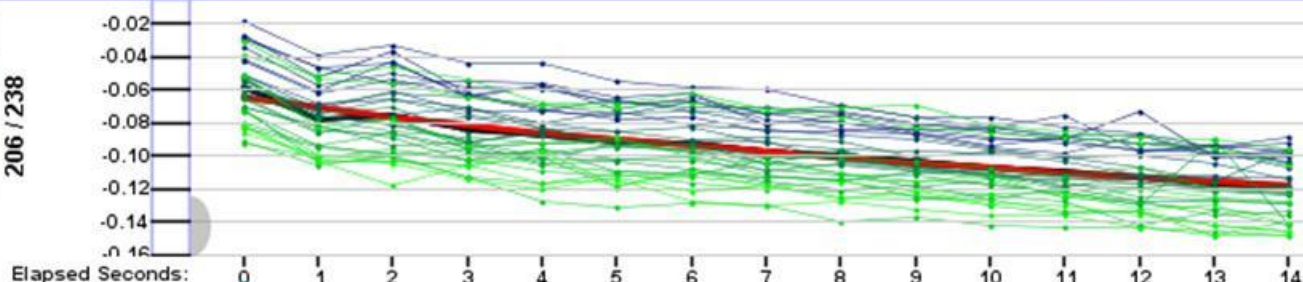
206 / 207

206 / 238

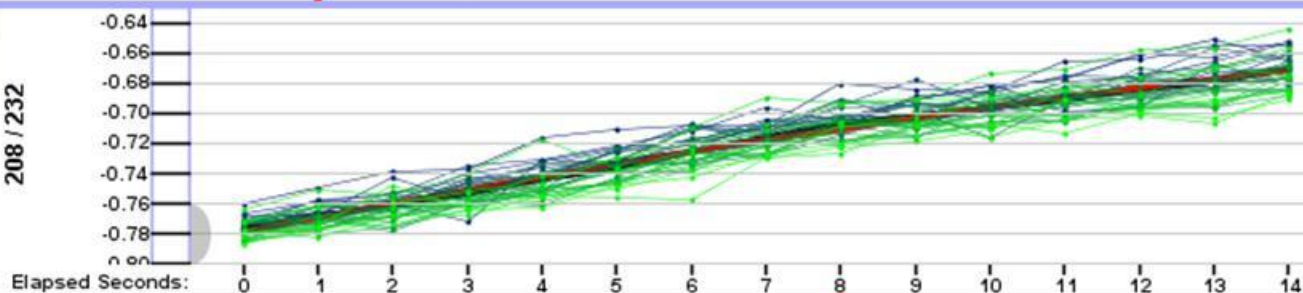
208 / 232



Residuals:



Residuals:



Residuals:

☐ MEAN SS☐ LINE SS☒ EXPONENTIAL SS $y = a * e^{(-b * x)} + c$ iter $a =$ Failed fit. $b =$ Failed fit. $c =$ Failed fit.☐ MEAN SS☐ LINE SS☒ EXPONENTIAL SS $y = a * e^{(-b * x)} + c$ iter $a =$ 0. $b =$ 0. $c =$ -0.☐ MEAN SS☐ LINE SS☒ EXPONENTIAL SS $y = a * e^{(-b * x)} + c$ iter $a =$ -0. $b =$ 0. $c =$ -0.

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Norm Prob Plot, Cum Prob Plot, Histograms, etc

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New tools welcomed!

Issues for Current (Legacy) Database:

Quality control during input?

From labs that have not described analytical methods?

Accept all types of data (e.g., not common Pb corrected)?

How deal with multiple analyses per grain?

How deal with samples with small N?