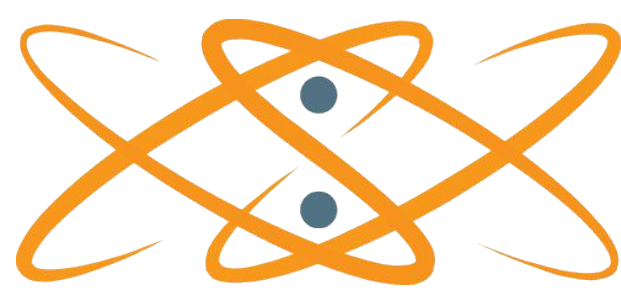




U-series Geochronologic Data

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Abstract

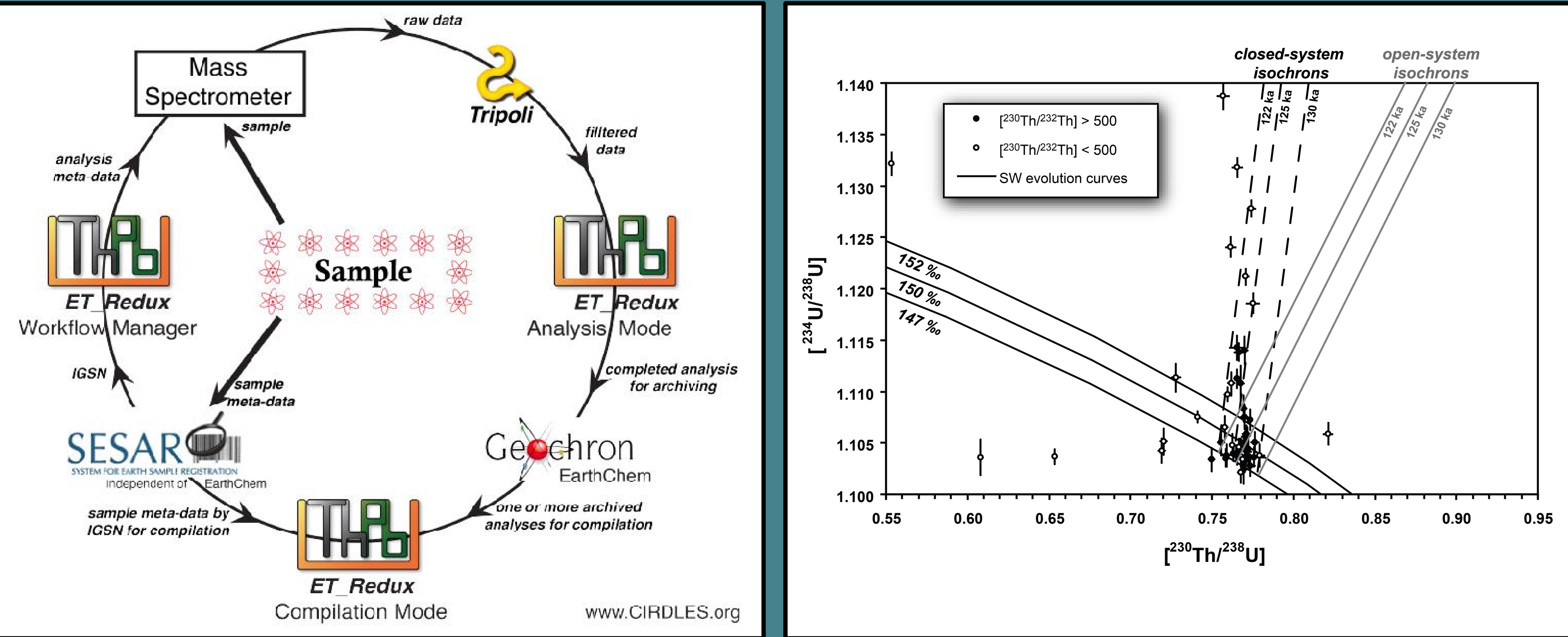
Uranium-series geochronology plays a critical role in understanding the time-scales and rates of climate change, sea-level change, and volcanic activity. There are no standardized data-handling protocols or community-based open data archives for raw isotopic data and reduced results. The U-series geochronology community wants to change this, encouraged by NSF's vision for 21st century cyberinfrastructure. In this pilot demonstration project, software engineers and geochronologists collaborate to build open-source cyberinfrastructure that standardizes and facilitates U-series data analysis, reporting, and archiving and analysis and re-processing of the vast amounts of legacy data. The project uses the NSF-funded EarthChem Geochron data repository that archives results from many dating schemes, stimulating inter-domain sharing and discovery. This cyberinfrastructure supports teaching and training at all levels and provides non-experts access to new knowledge.

This collaborative effort applies modern software engineering practices to solving the cyberinfrastructure problems of the U-series geochronology community, making the calculation, archiving, access, and interpretation activities of U-series geochronology as rigorous, seamless, and simple as possible. Currently, isotopic dates from U-series data are calculated and analyzed using legacy, platform-dependent software, and dates are difficult to synthesize because they have been published with disparate decay constants and reporting norms. This pilot project includes new software to calculate, visualize, and interpret U-series dates from new and legacy data, and new schema for data archiving at Geochron.org. Importantly, this project advances the sustainability of NSF's software ecosystem by building upon the cyberinfrastructure architecture already developed for the U-Pb geochronology community under the EARTHTIME umbrella.

Example of an acceptable data table for coral U-series ages. Values in parentheses are 2σ absolute uncertainties

IGSN	Analysis ID	²³⁸ U (ppm)	²³⁰ Th (ppt)	²³² Th (ppb)	[²³⁰ Th/ ²³² Th] ¹	[²³⁰ Th/ ²³⁸ U] ^{1,2}	[²³⁴ U/ ²³⁸ U] ^{1,3}	Date (ka) ⁴	δ ²³⁴ U init ‰
IEDUT100H	SY-27a	2.247 (0.003)	28.105 (0.045)	0.511 (0.001)	10261 (25)	0.7697 (0.0017)	1.1030 (0.0008)	127.0 (0.6)	147.4 (0.8)
IEDUT100I	SY-27b	2.234 (0.003)	28.100 (0.083)	0.668 (0.002)	7855 (22)	0.7738 (0.0026)	1.1028 (0.0011)	128.3 (0.8)	147.7 (1.1)
IEDUT100J	SY-27c	2.290 (0.003)	28.635 (0.056)	0.680 (0.002)	7861 (17)	0.7694 (0.0019)	1.1024 (0.0014)	127.0 (0.7)	146.6 (1.4)
IEDUT100L	SY-36a	4.546 (0.004)	56.616 (0.233)	4.921 (0.017)	2157 (6)	0.7694 (0.0032)	1.1042 (0.0007)	126.6 (1.0)	149.1 (1.0)
IEDUT100M	SY-36b	4.372 (0.002)	54.500 (0.117)	16.303 (0.049)	627 (2)	0.7701 (0.0017)	1.1050 (0.0009)	126.6 (0.6)	150.2 (1.2)
IEDUT100N	SY-36c	4.403 (0.003)	54.791 (0.093)	42.681 (0.091)	241 (1)	0.7689 (0.0014)	1.1034 (0.0008)	126.6 (0.5)	147.9 (1.0)

¹square brackets denote activity ratios.
²ratio determined using a Th-U spike calibrated to a secular equilibrium reference material (HU-1 aliquot at the ANU).
³ratio calibrated to a secular equilibrium reference material (HU-1 aliquot at the ANU).
⁴conventional, closed-system date calculated using the decay constants of Jaffey et al. (1971) for ²³⁸U and Cheng et al. (2013) for ²³⁰Th and ²³⁴U. Ages are reported relative to the date of analysis, January 2010, and do not include uncertainties associated with decay constants.



Publications Produced to Date

Fiona D. Hibbert, Eelco J. Rohling, Andrea Dutton, Felicity H. Williams, Peter M. Chutcharavan, Cheng Zhao, Mark E. Tamisiea. "Coral indicators of past sea-level change: A global repository of U-series dated benchmarks," *Quaternary Science Reviews*, v.145, 2016, p. 1. Doi:0277-3791.

Dutton et al. (in review) Data Reporting Standards for Publication of U-series Data for Geochronology and Timescale Assessment in the Earth Sciences, *Quaternary Geochronology*.