

The AuScope Open Science Ar-Ar Data Pipeline: From Instrument to EarthBank

Data Lifecycle Workflow from the Analytical Facility to the AuScope EarthBank Platform to the Researcher/Client

Bryant Ware¹, Hayden Dalton², Ashley Savelkouls², and Angus Nixon³

October 21st, 2025



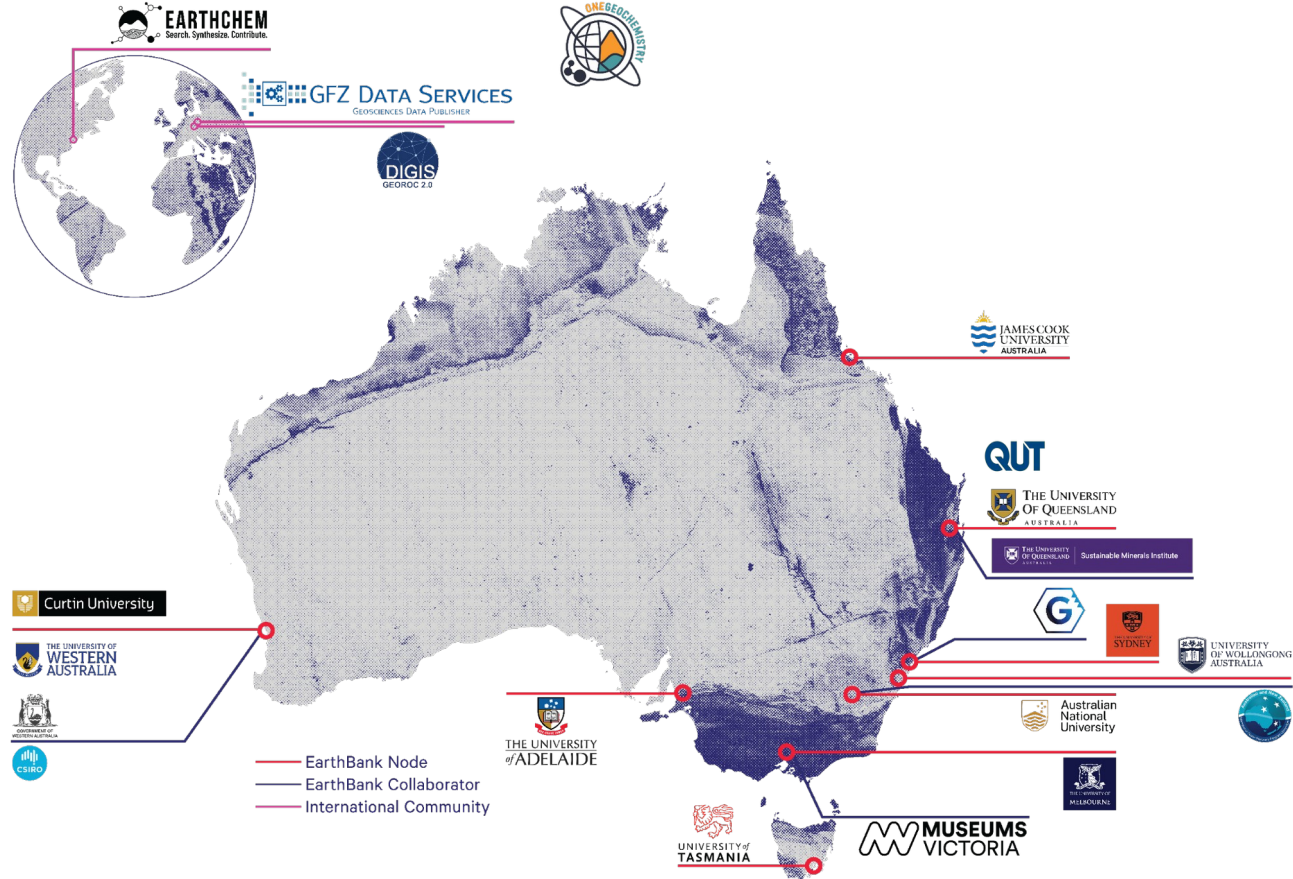
We acknowledge the Traditional Owners of the land on which our research infrastructure and community operate across the Australian continent, and specifically the Jagera people and the Turrbal people as the Traditional Custodians of Meanjin (Brisbane), the lands on which we meet today, and pay our respects to their Elders past and present. We extend that respect to Aboriginal and Torres Strait Islander peoples who may be joining us today.

We recognise the connection they have with the land, sea, sky and waterways for tens of thousands of years.



The AuScope Geochemistry Network | The AuScope EarthBank Project

- Established to create a national collaborative network of geochemistry laboratories
- Operating > \$100 million in laboratory infrastructure
- Training centres for applied geochemistry PhDs/EMCRs
- Analytical services to geoscience agencies and industry
- Nexus for international earth sciences collaborations



Challenges in a Growing Data Landscape

Growing geochemical data landscape

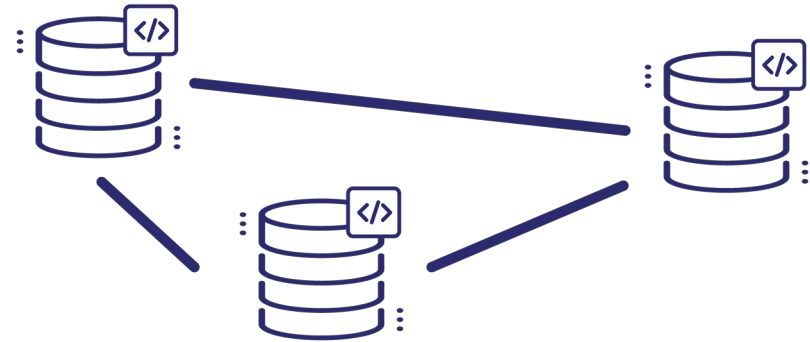
- Due to **advanced instrumentation**,



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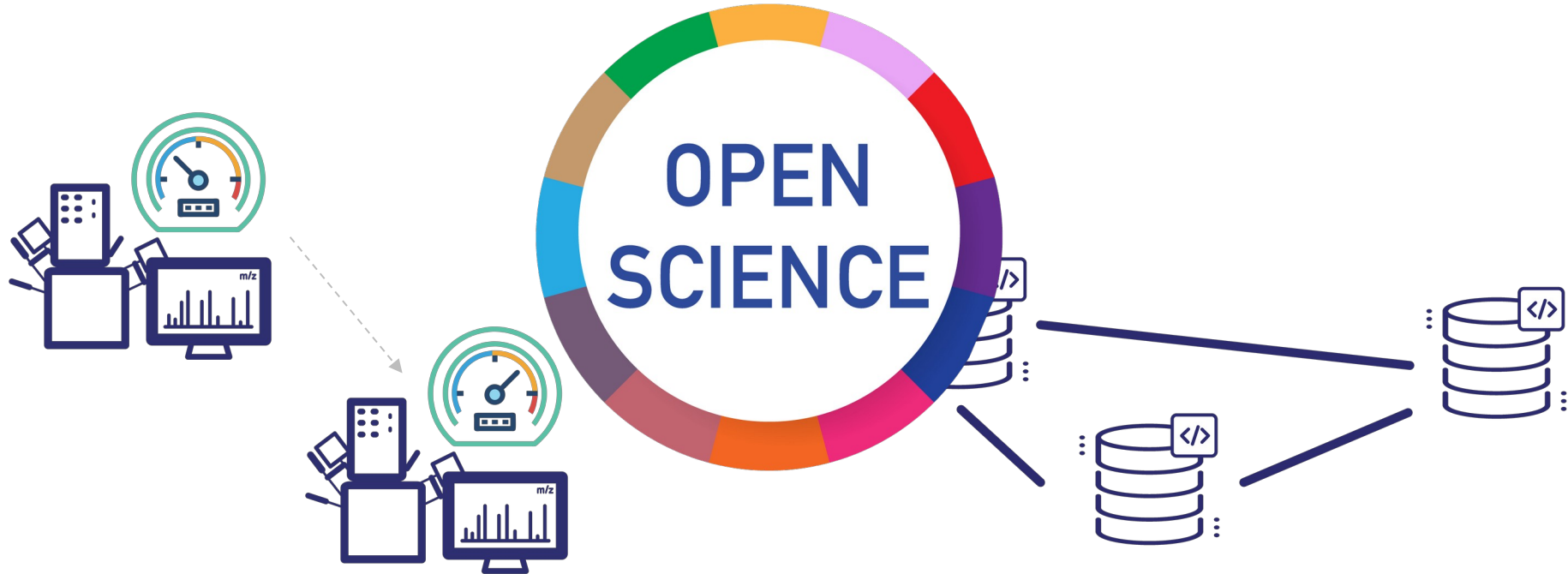
- Due to advanced instrumentation, **digital infrastructure technologies**,



Challenges in a Growing Data Landscape

Growing geochemical data landscape

- Due to advanced instrumentation, digital infrastructure technologies, and **Open Science** initiatives, there is a 'Digital Tsunami' of geochemical data.



Challenges in a Growing Data Landscape

Growing geochemical data landscape

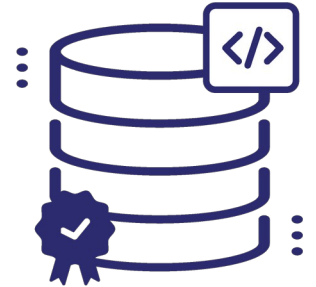
- Due to advanced instrumentation, digital infrastructure technologies, and Open Science initiatives, there is a 'Digital Tsunami' of geochemical data.
- Need for **clear guidelines**,



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Growing geochemical data landscape

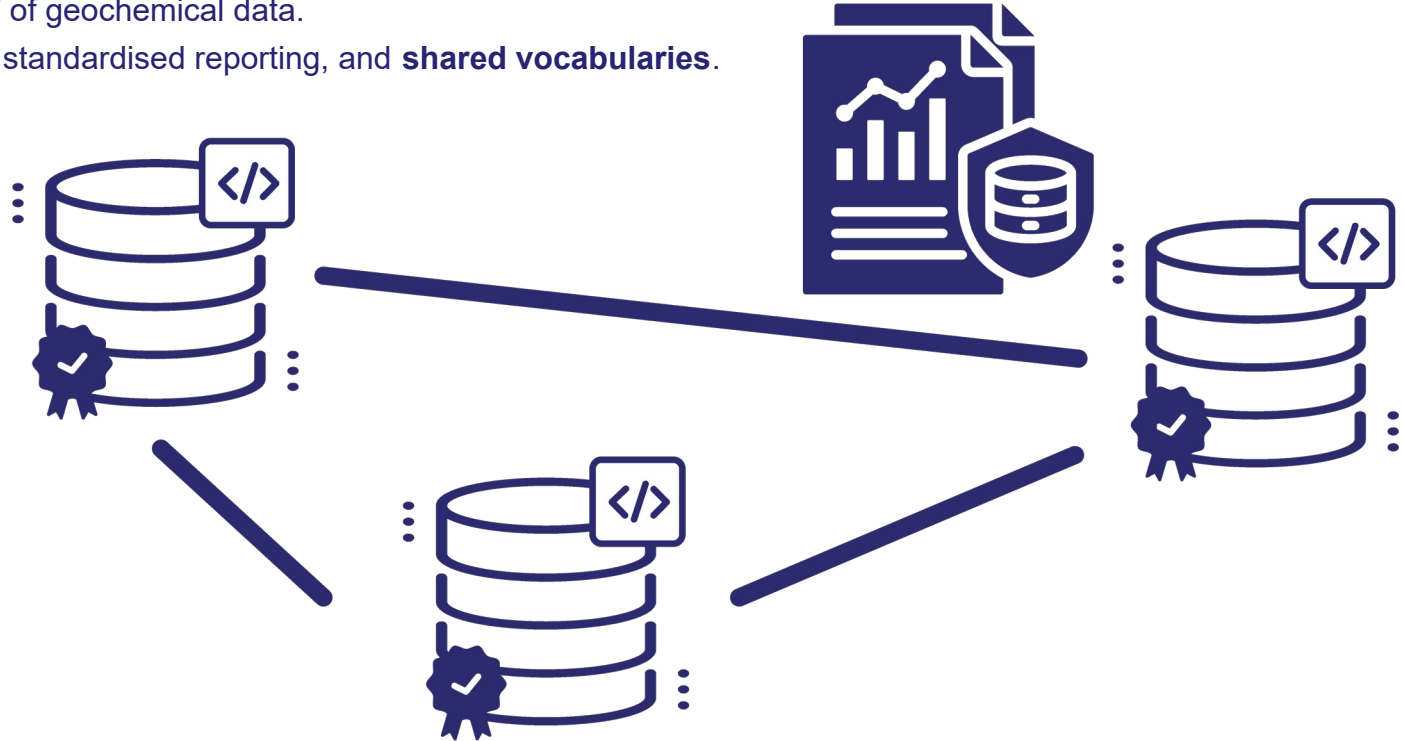
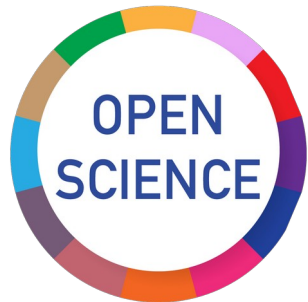
- Due to advanced instrumentation, digital infrastructure technologies, and Open Science initiatives, there is a 'Digital Tsunami' of geochemical data.
- Need for clear guidelines, **standardised reporting**,



Challenges in a Growing Data Landscape

Growing geochemical data landscape

- Due to advanced instrumentation, digital infrastructure technologies, and Open Science initiatives, there is a 'Digital Tsunami' of geochemical data.
- Need for clear guidelines, standardised reporting, and **shared vocabularies**.



Challenges in a Growing Data Landscape

Challenges in $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

- Widely used for dating geological events...



From meteorites as old as our solar system (~4.5 billion years ago)...

Throughout Earth's history...

To recent events such as the Vesuvius eruption (79 AD)

Challenges in a Growing Data Landscape

Challenges in $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

- Widely used for dating geological events... but produces complex datasets.

AutoSave TAS-01.full.xls - Compatibility Mode

Home Insert Draw Page Layout Formulas Data Review Comments Share

Clipboard Font Alignment Number Conditional Formatting Format as Table Cell Styles Cells Editing Sensitivity Add-ins

B6 \times \sqrt \int fx 5M13400

Incremental Heating	36Ar(a) [V]	37Ar(ga) [V]	38Ar(jc) [V]	39Ar(k) [V]	40Ar(f) [V]	Age $\pm 2\sigma$ (Ma)	40Ar(f) 39Ar(k) (%)	K/Ca $\pm 2\sigma$		
SM 13402	0.5%	0.000006	0.000039	0.0000169	0.0002427	382.29 \pm 3176.26	470.59	0.00	0.0118 \pm 0.0018	
SM 13403	1.0%	0.000006	0.000061	0.0000205	0.0003069	197.28 \pm 823.76	103.59	0.00	0.0198 \pm 0.0080	
SM 13403	1.5%	0.000074	0.019023	0.0000330	0.0007967	179.89 \pm 38.23	78.10	0.10	0.0180 \pm 0.0023	
SM 13405	2.0%	0.000007	0.020491	0.0000207	0.0101284	60.89 \pm 3.11	78.87	1.33	0.0185 \pm 0.0002	
SM 13405	2.5%	0.000161	0.012061	0.0000275	0.0001291	320.81 \pm 1.41	82.00	3.44	0.0183 \pm 0.0001	
SM 13407	3.0%	0.000142	0.023383	0.0000331	0.0391397	0.3960564	188.03 \pm 1.03	89.59	5.15	0.0182 \pm 0.0001
SM 13409	3.5%	0.000164	1.167062	0.0000191	0.0489599	0.4888848	182.26 \pm 0.91	94.11	6.45	0.0180 \pm 0.0001
SM 13410	4.0%	0.000083	1.289465	0.0000080	0.0534005	0.5387951	183.57 \pm 0.87	95.33	7.03	0.0181 \pm 0.0001
SM 13411	4.5%	0.000020	1.276818	0.0000228	0.0500333	0.5006399	183.19 \pm 0.91	96.43	6.67	0.0179 \pm 0.0001
SM 13413	5.0%	0.000020	1.290491	0.0000333	0.0502664	0.5007291	184.10 \pm 0.92	96.49	6.63	0.0180 \pm 0.0001
SM 13414	5.5%	0.000068	1.049028	0.0000000	0.0443386	0.4477582	183.70 \pm 0.95	96.35	5.84	0.0182 \pm 0.0001
SM 13415	6.0%	0.000068	0.939770	0.0000000	0.0416712	0.4168476	184.05 \pm 0.89	96.39	5.41	0.0180 \pm 0.0001
SM 13417	7.0%	0.000070	1.249540	0.0000033	0.0523779	0.5271871	183.34 \pm 0.89	95.74	6.89	0.0180 \pm 0.0001
SM 13418	8.0%	0.000015	1.091468	0.0000003	0.0497723	0.4989837	183.03 \pm 0.94	96.15	6.02	0.0180 \pm 0.0001
SM 13419	10.0%	0.000043	1.278050	0.0000000	0.0496420	0.4966465	184.38 \pm 0.83	96.48	7.25	0.0184 \pm 0.0001
SM 13421	12.0%	0.000032	1.263441	0.0000000	0.0491278	0.4948800	183.19 \pm 0.98	96.32	6.47	0.0187 \pm 0.0001
SM 13423	15.0%	0.000048	0.939770	0.0000000	0.0416712	0.4168476	184.05 \pm 0.89	96.39	5.41	0.0180 \pm 0.0001
SM 13423	18.0%	0.000030	0.839564	0.0000000	0.0318687	0.3221116	183.91 \pm 1.21	96.50	4.19	0.0183 \pm 0.0001
SM 13425	21.0%	0.000185	0.793905	0.0000210	0.0250278	0.2570209	183.58 \pm 1.41	97.60	3.36	0.0155 \pm 0.0001
SM 13426	24.0%	0.000098	0.793905	0.0000000	0.0202025	0.2020794	183.86 \pm 1.70	97.01	2.64	0.0153 \pm 0.0001
SM 13427	27.0%	0.000192	0.532879	0.0000000	0.0126454	0.1264786	183.18 \pm 2.58	95.64	1.65	0.0182 \pm 0.0001
SM 13428	30.0%	0.000011	0.344546	0.0000000	0.1288771	0.1288771	181.86 \pm 2.80	93.18	1.67	0.0189 \pm 0.0001
SM 13430	35.0%	0.000027	0.514700	0.0000000	0.1995654	0.1915247	182.82 \pm 1.79	96.57	2.51	0.0198 \pm 0.0001
SM 13431	40.0%	0.000015	0.295568	0.0000000	0.0117715	0.1126347	183.11 \pm 2.86	94.58	1.47	0.0180 \pm 0.0002
SM 13432	45.0%	0.000026	0.278962	0.0000000	0.0091869	0.0091284	184.20 \pm 2.49	91.66	1.21	0.0165 \pm 0.0002
SM 13433	50.0%	0.000043	0.340194	0.0000002	0.0140780	0.1410652	183.07 \pm 2.27	91.75	1.85	0.0177 \pm 0.0002
Σ										

Information on Analysis

Sample = TAS-01
Material = pig
Location = Laser
Analysis = Frited Journal
Project = FERRAR_SIV214
Mass Discrimination Law = POW
Irradiation = ID049
 $\pm 0.0198000 \pm 0.0000005$
 $\text{GA}1500 = 39.726 \pm 0.100 \text{ Ma}$

Results	40Ar/39Ar(k) $\pm 2\sigma$	Age $\pm 2\sigma$ (Ma)	MSWD	39Ar(k) (% n)	K/Ca $\pm 2\sigma$
Age Plateau	10.09220 $\pm 0.15\%$	183.59 ± 0.34 Full External Error ± 1.34 Analytical Error ± 0.27	0.68	83.52	0.0171 ± 0.0005
Total Fusion Age	10.09780 $\pm 0.15\%$	183.68 ± 0.33 Full External Error ± 1.34 Analytical Error ± 0.26	26	0.0174 ± 0.0000	

Incremental Heating Summary Normal Isochron Table Inverse Isochron Table Relative Abundance

Ready Accessibility: Unavailable

Challenges in a Growing Data Landscape

Challenges in $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

- Widely used for dating geological events... but produces complex datasets.

The screenshot displays a Microsoft Excel spreadsheet titled "TAS-01.full.xls" in "Compatibility Mode". The interface includes the standard Excel ribbon (Home, Insert, Draw, Page Layout, Formulas, Data, Review, Comments) and a main data area. The data area is organized into several sections:

- Relative Abundances Table:** A large table with columns for isotope ratios (36Ar, 37Ar, 38Ar, 39Ar, 40Ar, 40Ar/39Ar) and their respective abundances. The table includes a summary row at the bottom with values like 0.001427, 18.21131, 40(p)36(s) ± 2σ, and 40(p).
- Incremental Heating Summary:** A table on the left side listing heating steps (SM13402 to SM13433) and their parameters, including 36Ar, 37Ar, and 40Ar/39Ar ratios.
- Information on Analysis and Constants Used in Calculations:** A section providing details about the sample (TAS-01), material (plg), and various decay constants and half-lives used in the calculations.
- Results:** A section showing calculated ages and uncertainties, including a total fusion age of 291 ± 46.29 ± 15.88%.
- Age Plateau:** A section providing information about the age plateau, including the age (291 ± 46.29 ± 15.88%) and the standard deviation (± 15.88%).

The spreadsheet also includes various formulas and cell references, such as "=SUMIF" and "=AVERAGE". The status bar at the bottom indicates "Ready" and "Accessibility: Unavailable".

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The screenshot displays a spreadsheet application with multiple overlapping windows. The primary window shows a data table with columns for 'Incremental Heating', 'Standard (in Ma)', '%α', 'J', '%α', 'MDF', '%α', 'Volume Ratio', 'Sensitivity (mol/vol)', 'Day', 'Month', 'Year', 'Hour', 'Min', 'Resist', 'Irradiation', and 'Project'. The data is organized into a table with multiple rows of measurements. Below the table, there are sections for 'Information on Analysis and Constants Used in Calculations', 'Results', 'Age Plateau', and 'Total Fusion Age'. The spreadsheet also shows various formulas and calculations, such as '36Ar(a) [V]' and '37Ar(a) [V]'. The interface includes standard spreadsheet controls like 'Home', 'Insert', 'Draw', 'Page Layout', 'Formulas', 'Data', 'Review', and 'Comments' tabs, along with a ribbon and a status bar at the bottom.

Challenges in a Growing Data Landscape

Challenges in $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

- Widely used for dating geological events... but produces complex datasets.

The image displays three overlapping Microsoft Excel spreadsheets used for $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology data analysis. The spreadsheets are titled 'TAS-01.full.xls - Compatibility Mode'.

Spreadsheet 1 (Left): Shows 'Relative Abundances' for various samples (SM13400 to SM13433). The columns include sample ID, $^{36}\text{Ar}(a)$ [V], $^{37}\text{Ar}(a)$ [V], and relative abundance percentages. A summary table at the bottom provides 'Information on Analysis and Constants Used in Calculations'.

Sample	$^{36}\text{Ar}(a)$ [V]	$^{37}\text{Ar}(a)$ [V]	Relative Abundance (%)
SM13400	0.5	0.000006	0.000006
SM13401	1.5	0.000007	0.000005
SM13402	2.5	0.000007	0.000003
SM13403	3.5	0.000007	0.000002
SM13404	4.5	0.000007	0.000001
SM13405	5.5	0.000007	0.000001
SM13406	6.5	0.000007	0.000001
SM13407	7.5	0.000007	0.000001
SM13408	8.5	0.000007	0.000001
SM13409	9.5	0.000007	0.000001
SM13410	10.5	0.000007	0.000001
SM13411	11.5	0.000007	0.000001
SM13412	12.5	0.000007	0.000001
SM13413	13.5	0.000007	0.000001
SM13414	14.5	0.000007	0.000001
SM13415	15.5	0.000007	0.000001
SM13416	16.5	0.000007	0.000001
SM13417	17.5	0.000007	0.000001
SM13418	18.5	0.000007	0.000001
SM13419	19.5	0.000007	0.000001
SM13420	20.5	0.000007	0.000001
SM13421	21.5	0.000007	0.000001
SM13422	22.5	0.000007	0.000001
SM13423	23.5	0.000007	0.000001
SM13424	24.5	0.000007	0.000001
SM13425	25.5	0.000007	0.000001
SM13426	26.5	0.000007	0.000001
SM13427	27.5	0.000007	0.000001
SM13428	28.5	0.000007	0.000001
SM13429	29.5	0.000007	0.000001
SM13430	30.5	0.000007	0.000001
SM13431	31.5	0.000007	0.000001
SM13432	32.5	0.000007	0.000001
SM13433	33.5	0.000007	0.000001

Spreadsheet 2 (Middle): Shows 'Irradiation Constants' for various samples (SM13400 to SM13433). The columns include sample ID, $^{40}\text{Ar}/^{39}\text{Ar}$ ratio, $\% \sigma$, and other parameters.

Sample	$^{40}\text{Ar}/^{39}\text{Ar}$	$\% \sigma$
SM13400	0.5	296.6
SM13401	1.5	296.6
SM13402	2.5	296.6
SM13403	3.5	296.6
SM13404	4.5	296.6
SM13405	5.5	296.6
SM13406	6.5	296.6
SM13407	7.5	296.6
SM13408	8.5	296.6
SM13409	9.5	296.6
SM13410	10.5	296.6
SM13411	11.5	296.6
SM13412	12.5	296.6
SM13413	13.5	296.6
SM13414	14.5	296.6
SM13415	15.5	296.6
SM13416	16.5	296.6
SM13417	17.5	296.6
SM13418	18.5	296.6
SM13419	19.5	296.6
SM13420	20.5	296.6
SM13421	21.5	296.6
SM13422	22.5	296.6
SM13423	23.5	296.6
SM13424	24.5	296.6
SM13425	25.5	296.6
SM13426	26.5	296.6
SM13427	27.5	296.6
SM13428	28.5	296.6
SM13429	29.5	296.6
SM13430	30.5	296.6
SM13431	31.5	296.6
SM13432	32.5	296.6
SM13433	33.5	296.6

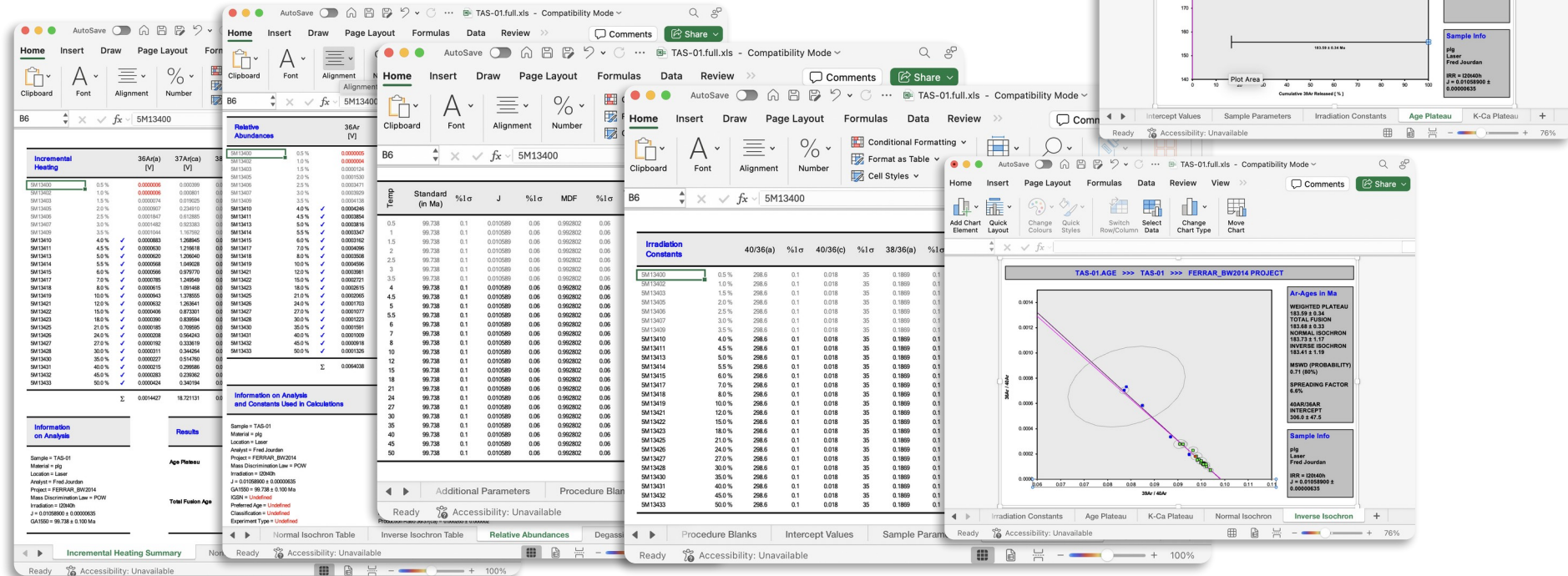
Spreadsheet 3 (Right): Shows 'Age Plateau' for various samples (SM13400 to SM13433). The columns include sample ID, age, $\% \sigma$, and other parameters.

Sample	Age (Ma)	$\% \sigma$
SM13400	0.5	296.6
SM13401	1.5	296.6
SM13402	2.5	296.6
SM13403	3.5	296.6
SM13404	4.5	296.6
SM13405	5.5	296.6
SM13406	6.5	296.6
SM13407	7.5	296.6
SM13408	8.5	296.6
SM13409	9.5	296.6
SM13410	10.5	296.6
SM13411	11.5	296.6
SM13412	12.5	296.6
SM13413	13.5	296.6
SM13414	14.5	296.6
SM13415	15.5	296.6
SM13416	16.5	296.6
SM13417	17.5	296.6
SM13418	18.5	296.6
SM13419	19.5	296.6
SM13420	20.5	296.6
SM13421	21.5	296.6
SM13422	22.5	296.6
SM13423	23.5	296.6
SM13424	24.5	296.6
SM13425	25.5	296.6
SM13426	26.5	296.6
SM13427	27.5	296.6
SM13428	28.5	296.6
SM13429	29.5	296.6
SM13430	30.5	296.6
SM13431	31.5	296.6
SM13432	32.5	296.6
SM13433	33.5	296.6

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- Widely used for dating geological events... but produces complex datasets.



Challenges in a Growing Data Landscape

Challenges in $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

- Widely used for dating geological events, but produces complex datasets.
- Requires detailed documentation, corrections, and often recalculation or recalibration.
- Existing reporting standards (e.g., Schaen et al. 2021) exist, but adoption is difficult.

TABLE 4. CHECKLIST OF MINIMUM AND RECOMMENDED DATA TO REPORT FOR $^{40}\text{Ar}/^{39}\text{Ar}$ DATES

Minimum required data (✓)	
<input type="checkbox"/>	Report uncertainties for all parameters (e.g., 95% confidence interval, 1σ , 2σ)
<input type="checkbox"/>	Explicitly state whether uncertainties on ages include decay constant uncertainties
<input type="checkbox"/>	Report sample identifier (ideally unique, e.g., International Geo Sample Number [IGSN])
<input type="checkbox"/>	Report sample location (e.g., latitude, longitude, elevation)
<input type="checkbox"/>	Report sample lithology
<input type="checkbox"/>	Specify material analyzed (e.g., single vs. multicrystal aliquot, weight, phase type)
<input type="checkbox"/>	Report relative isotope abundances [†] for ^{40}Ar , ^{39}Ar , ^{38}Ar , ^{37}Ar , and ^{36}Ar
<input type="checkbox"/>	Describe step-heating schedule and/or laser power/wattage per analysis
<input type="checkbox"/>	Identify reactor and port used for irradiation (and if Cd shielding or rotation was used)
<input type="checkbox"/>	Describe fluence monitor details (e.g., name, age assumed, reference, calculated J value)
<input type="checkbox"/>	Report decay constants used (e.g., ^{40}K , ^{39}Ar , ^{37}Ar , ^{36}Cl), references cited
<input type="checkbox"/>	Identify interfering isotope production ratios (e.g., Ar produced from K, Ca, Cl), references cited
<input type="checkbox"/>	Report ratios used for trapped [§] argon correction ($^{40}\text{Ar}/^{36}\text{Ar}$, $^{40}\text{Ar}/^{38}\text{Ar}$), reference cited
<input type="checkbox"/>	Indicate time interval used in decay corrections (e.g., days from end of irradiation to start of analysis)
<input type="checkbox"/>	Report proportion radiogenic ^{40}Ar ($\%^{40}\text{Ar}^*$)
<input type="checkbox"/>	Provide model age and unit of each analysis (e.g., a, ka, Ma, Ga)
<input type="checkbox"/>	List F value ($^{40}\text{Ar}^*/^{39}\text{Ar}_k$) and its uncertainty
<input type="checkbox"/>	Distinguish which steps are included in the age spectrum/isochron
<input type="checkbox"/>	Report statistics to evaluate robustness of data (e.g., mean square of weighted deviates [MSWD], p value)
<input type="checkbox"/>	Publish data tables in tabular (e.g., CSV, XLS) or machine-readable (e.g., JSON/XML) file formats
Recommended data	
<input type="checkbox"/>	Describe sample treatment (e.g., mineral separation techniques, acid treatment used)
<input type="checkbox"/>	Identify data reduction software used (e.g., Mass Spec, ArArCALC, Pychron, in-house)
<input type="checkbox"/>	List grain size of material analyzed
<input type="checkbox"/>	Report representative blank measurements
<input type="checkbox"/>	Report frequency of blank/air/cocktail measurements

[†]Corrected for baseline, background, mass discrimination, and/or detector intercalibration, reactor interferences, and radioactive decay.

[§]For terrestrial samples, this is commonly the composition of atmospheric argon.

Challenges in a Growing Data Landscape

Barriers to effective data sharing

- Manual data entry is common and often misses key instrument outputs.
- Lack of simple, accessible digital tools.



Instrument metadata



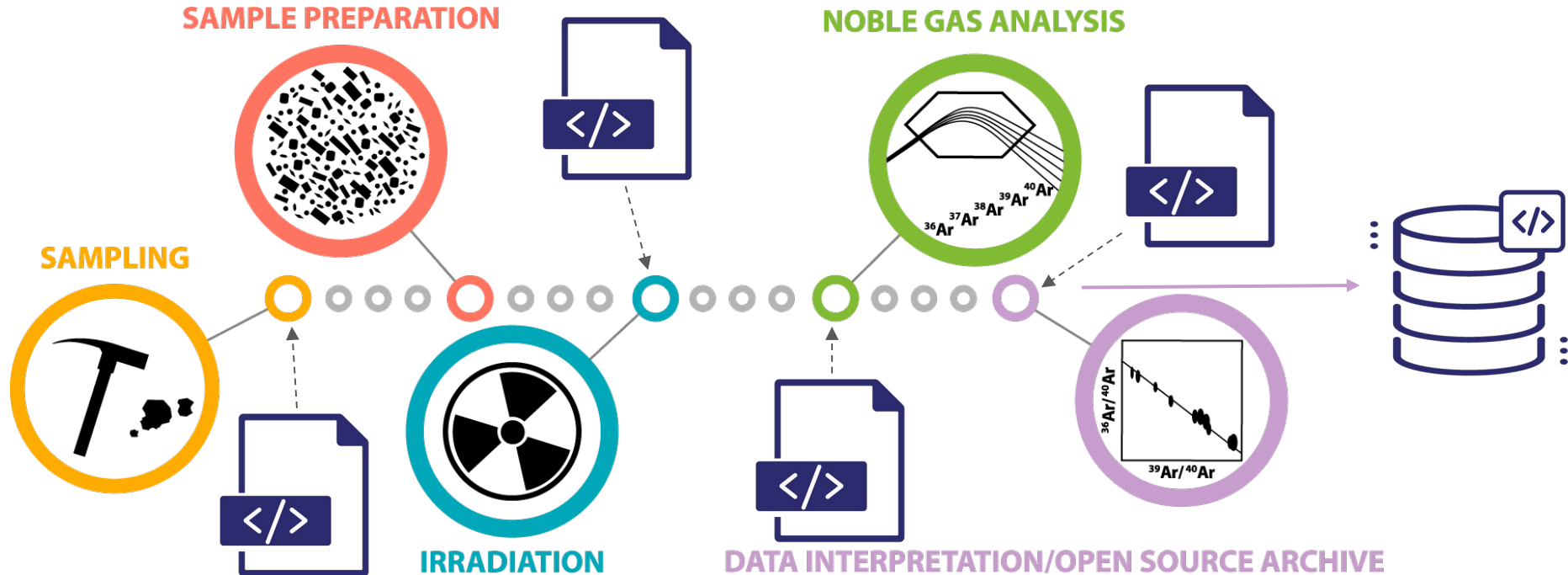
Automation

Workflows

AuScope Geochemistry Network initiatives

Streamlined metadata collection

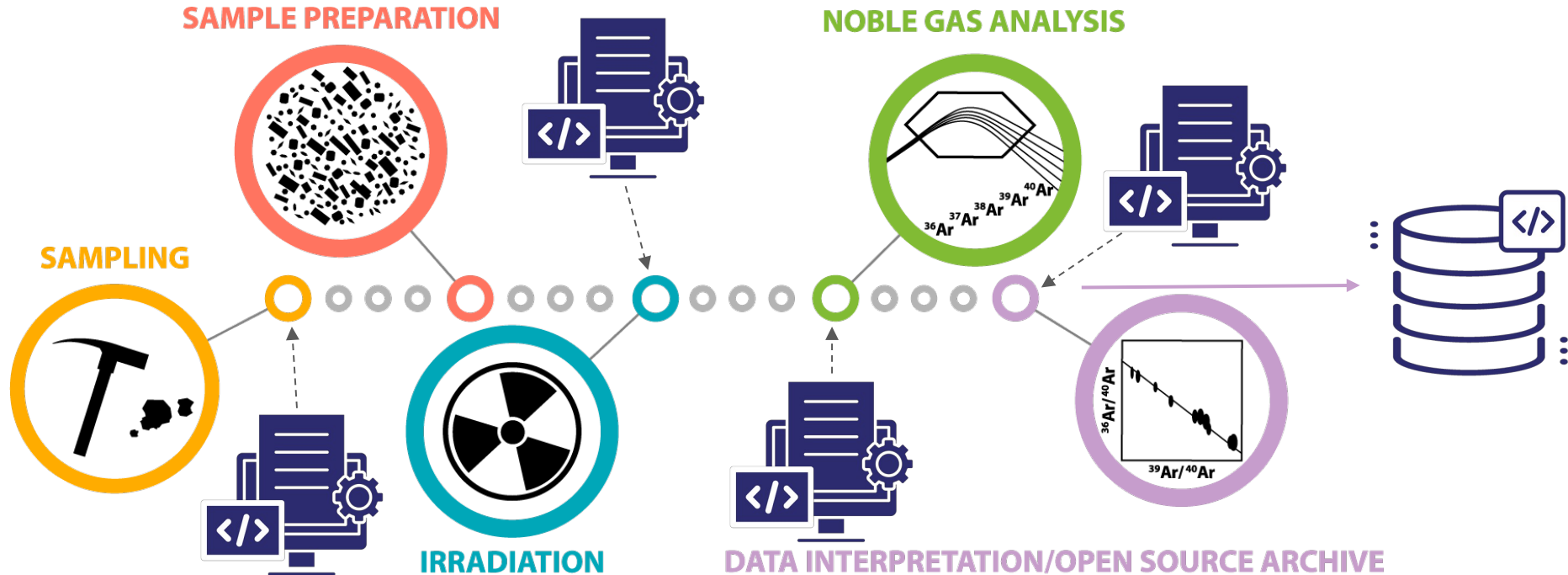
- Integrating essential metadata capture without adding extra burden to workflows.



AuScope Geochemistry Network initiatives

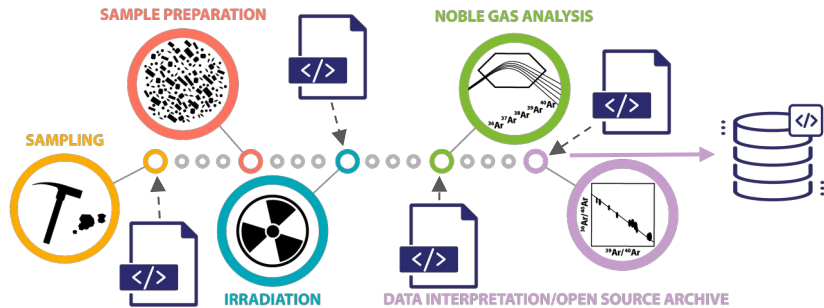
Automated, open-source data capture

- Tools (Pychron) for direct upload to trusted repositories (AuScope Data Repository, EarthBank).



AuScope Geochemistry Network initiatives

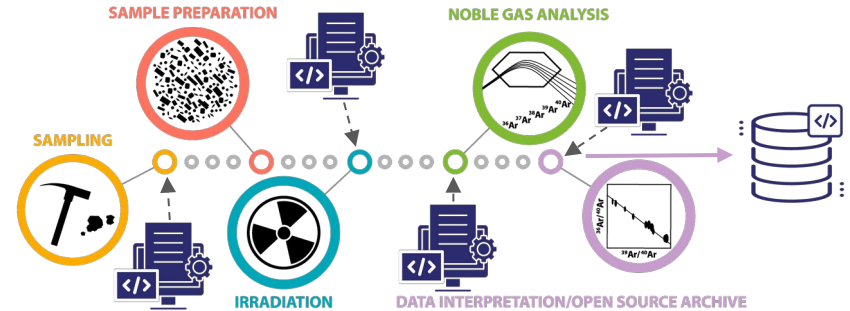
1. Streamlined metadata collection



Integrating essential metadata capture into the analytical facilities workflow is more adaptable across methods and laboratories.

However, requires manual data entry which can be laborious and can result in missing key instrument output.

2. Automated, open-source data capture



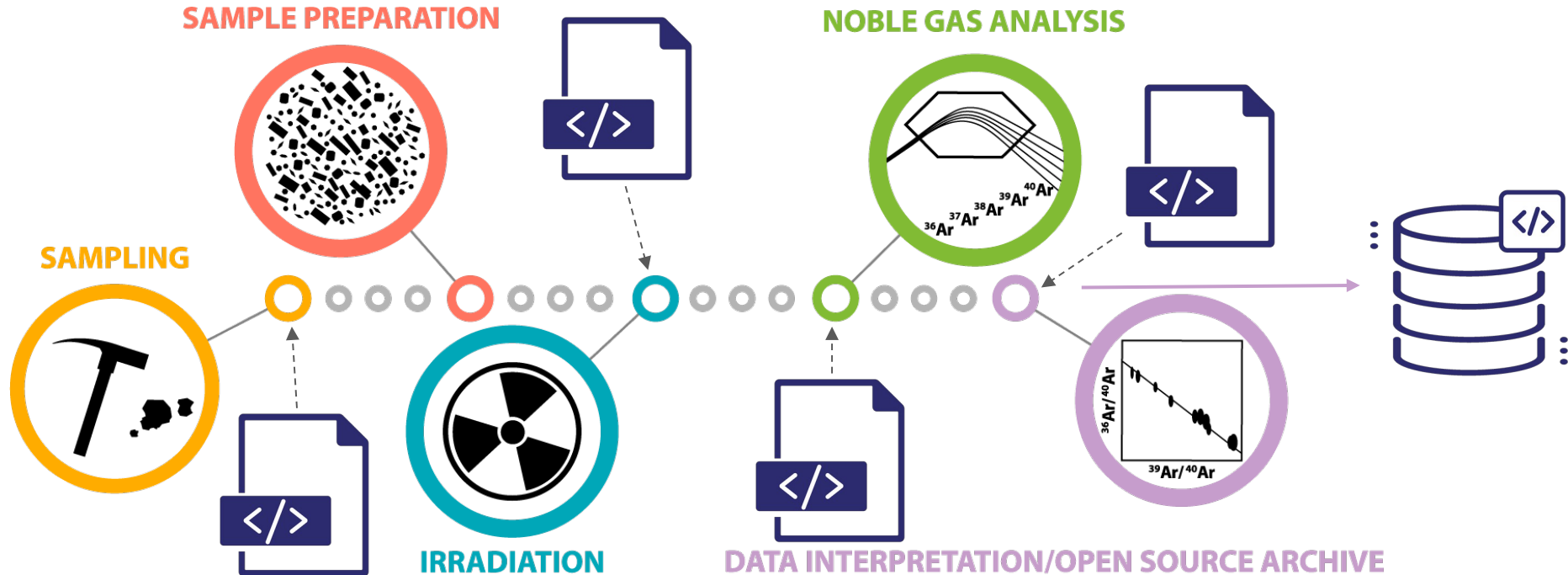
Tools for direct upload to trusted repositories ensure the capture of all metadata, ease of use.

However, typically domain, method, laboratory, researcher specific.

AuScope Geochemistry Network initiatives

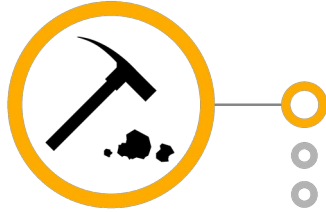
Streamlined metadata collection

- Integrating essential metadata capture without adding extra burden to workflows.



$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

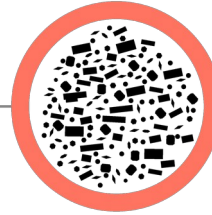


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

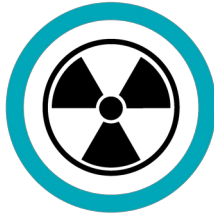
SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

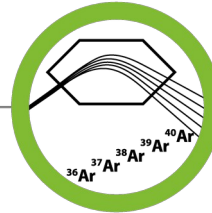


IRRADIATION

2 to 6 months

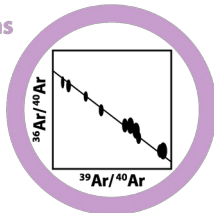
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
- Ar isotope data reduction

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



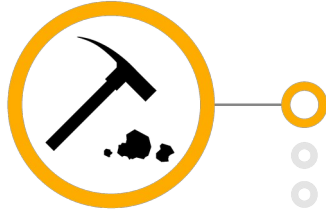
DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

TOTAL TIME : 3-12 months

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

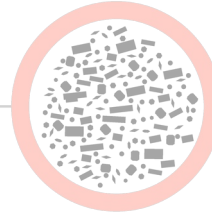


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

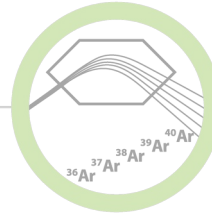


IRRADIATION

2 to 6 months

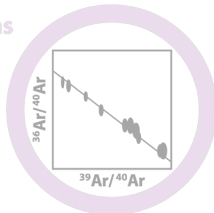
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
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- isochrons
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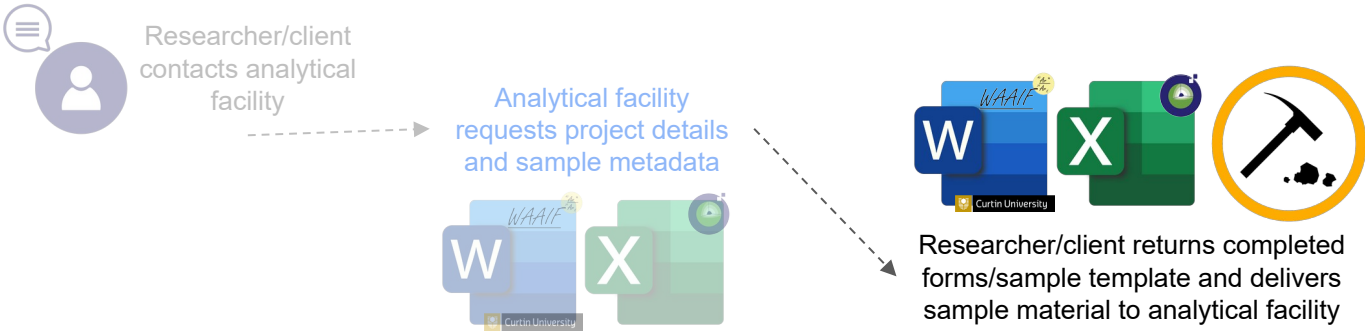
DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

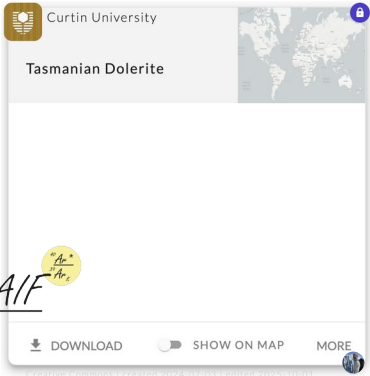
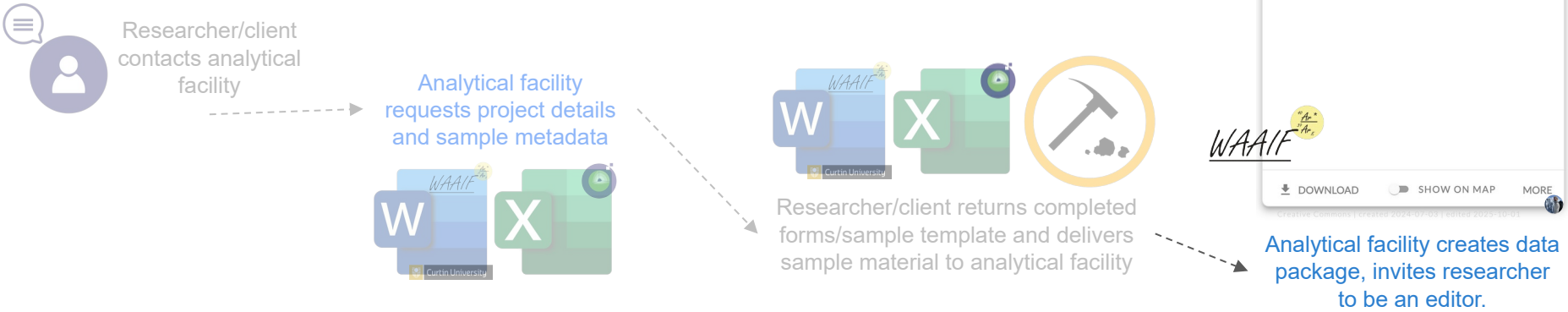
AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata



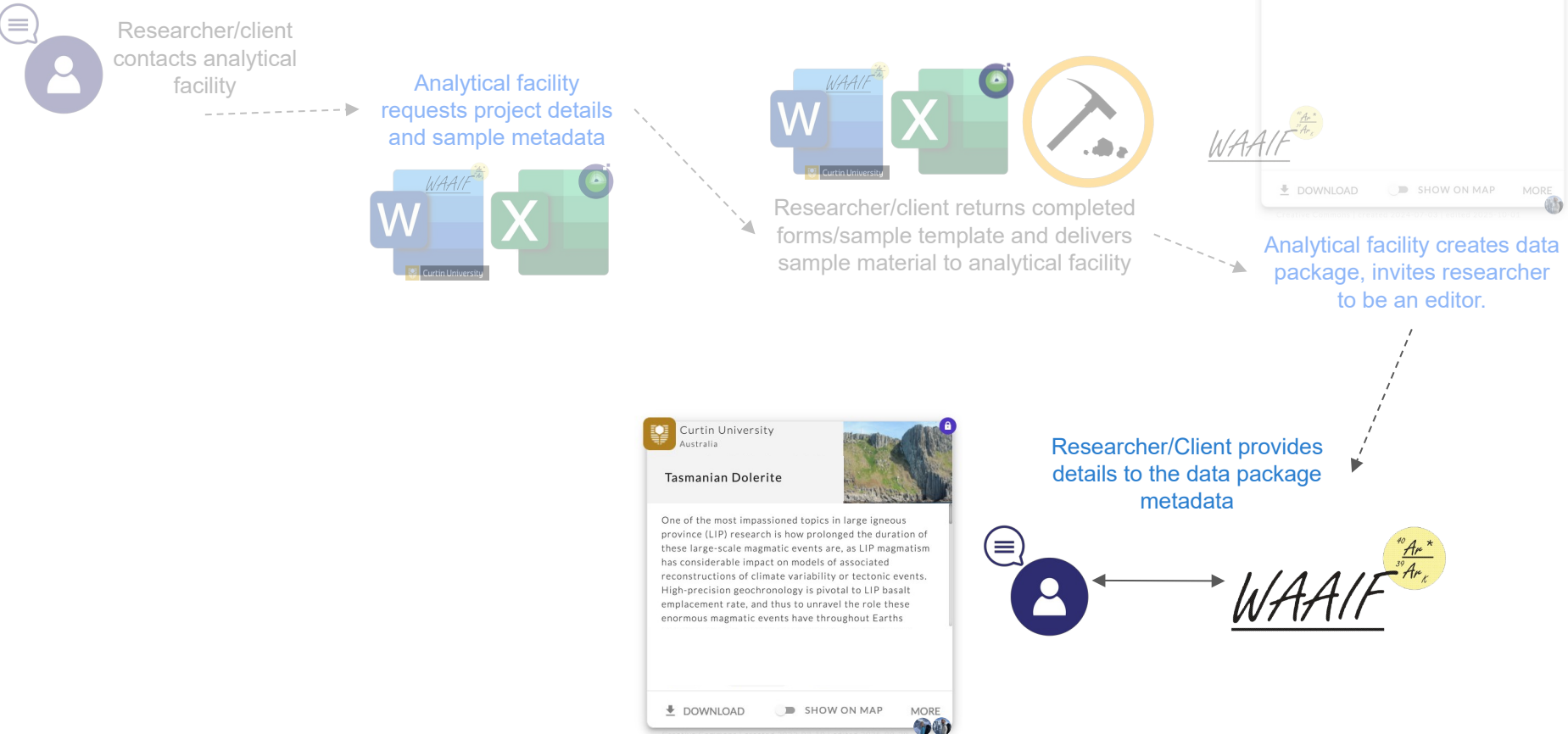
AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata



AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata



AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata



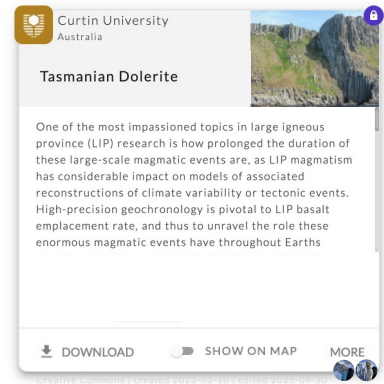
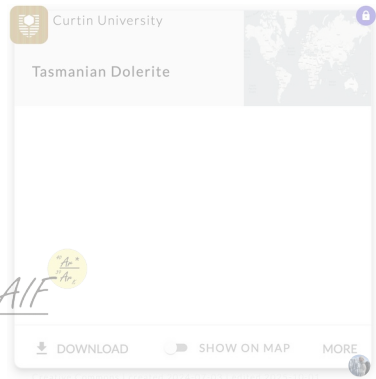
Researcher/client contacts analytical facility

Analytical facility requests project details and sample metadata

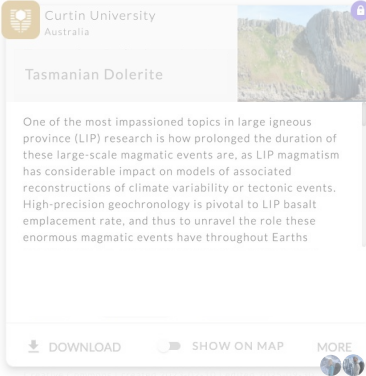
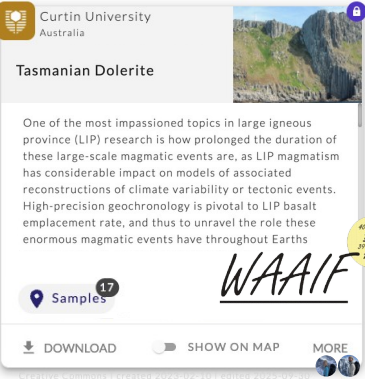
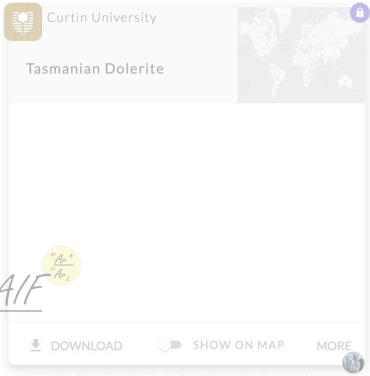
Researcher/client returns completed forms/sample template and delivers sample material to analytical facility

Analytical facility creates data package, invites researcher to be an editor.

Researcher/Client provides details to the data package metadata



AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata



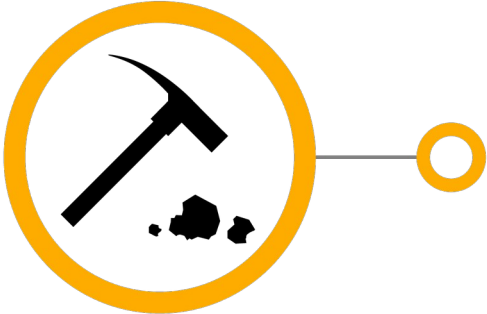
Analytical facility uploads sample metadata to data package

AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata

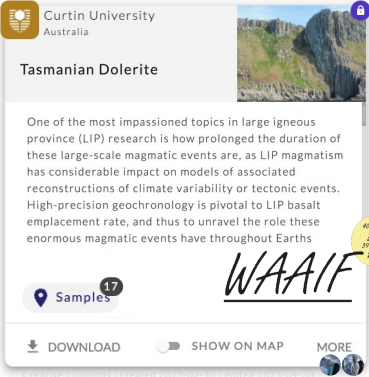
OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

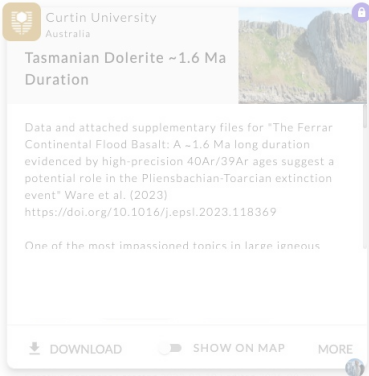
- lithology
- latitude
- longitude
- altitude
- geologic context



Analytical facility requests project details and sample metadata



Analytical facility uploads sample metadata to data package



Researcher/Client provides details to the data package metadata



AuScope Ar-Ar Data Pipeline: Workflow – Sample Metadata

OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks



geologic context

lithology

latitude

longitude

altitude

WAAIF Project Details Summary BLANK - Co

Home Insert Draw Design Layout References >> Comments Editing

Project title (one sentence):

Short description of project (2-3 sentences only; feel free to attach any relevant paper):

Approximate age of samples (required to determine the duration of sample irradiation):

General description of rock type (eg, Basalt, Gabbro, Tuff etc.):

Page 2 of 2 175 words

Sample.template.v2025-04-16_WareTasmaniaEPSL2023

	A	C	D	E	F	G	H	J
	ID of sample, usually assigned by sample collector (Must be unique within the whole AuScope EarthBank platform)	The type of sample material; Selectable from list (rock, Gas, soil, loose sediment, fossil, mineral, vein, ore, etc.)	The sample collection method; Selectable from list (e.g. grab, core, drilling, cutting, etc.)	The composition or type of rock sample, e.g. sandstone, limestone, chert, coal. Selectable from list. Supported by mindal.org (If desired material is not available in current list, more options may be available during upload)	Additional information about sample (kind, collection method, lithology/mineral)	A geographic coordinate that specifies the north-south position of a point on the Earth's surface (in decimal degrees)	A geographic coordinate that specifies the east-west position of a point on the Earth's surface (in decimal degrees)	Elevation of (sampling) location, at ground level (above mean sea level) (auto determined for surface samples from lat/long, if not defined)
1	String	List	List	List	Text	Numeric (WGS84)	Numeric (WGS84)	Numeric
2	Sample Name	Sample Kind (search term)	Sampling Method (search term)	Rock/Mineral (search term)	Notes on Sample	Latitude (WGS84)	Longitude (WGS84)	Ground Elevation [m]
3	sampleName	sampleKind	sampleMethod	material	sampleComment	latitude	longitude	elevationGround
4	TAS-01	Rock	Hand Sample	Dolerite	Mafic Pygmetite, < 1 mm - 2 mm elongate axis	-43.49927778	146.8803333	25
5	TAS-19	Rock	Hand Sample	Dolerite	Fresh	-41.57022222	147.2384167	6

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context



SAMPLE PREPARATION

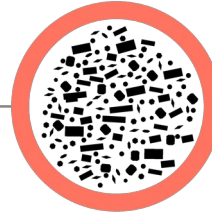
1 to 3 weeks

- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)



OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

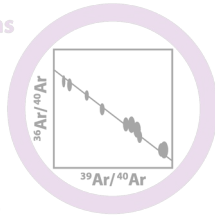
IRRADIATION

2 to 6 months

NOBLE GAS ANALYSIS

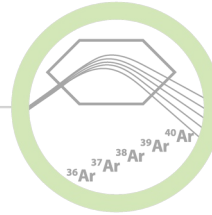
1 to 4 weeks

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
- Ar isotope data reduction

AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation



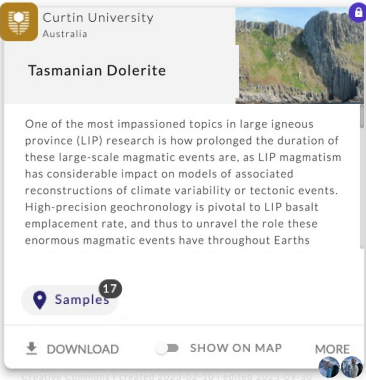
Analytical facility processes samples and records analytical metadata directly into the AuScope EarthBank platform.



Analytical facility continues to update data package with sample metadata during sample processing.



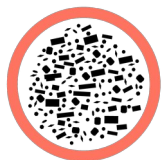
Sample Preparation



AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

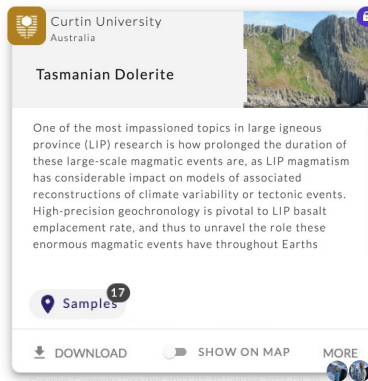


Analytical facility processes samples and records analytical metadata directly into the AuScope EarthBank platform.



Analytical facility continues to update data package with sample metadata during sample processing.

Sample Preparation

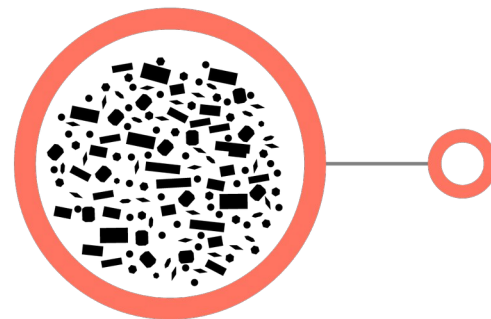


Record number of grains or weight of population of grains processed for analysis.

- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

SAMPLE PREPARATION

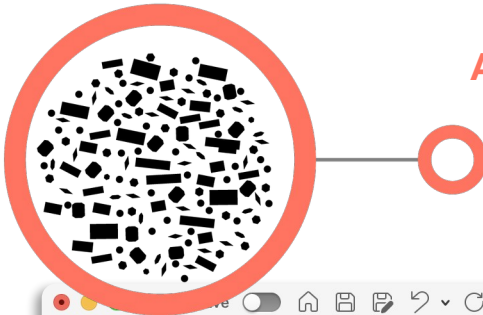
1 to 3 weeks



AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

SAMPLE PREPARATION

1 to 3 weeks



Aliquot size

Aliquot Metadata (grain size)

Sample Name	Analysis Scale	Mineral Type	Grain diameter (min)	Grain diameter (max)	Analyte comment
TAS-01	Multi-Grain Aliquot	Plagioclase	125	212	mineral separation
TAS-14	Multi-Grain Aliquot	Plagioclase	125	212	mineral separation
TAS-19	Multi-Grain Aliquot	Plagioclase	125	212	mineral separation
TAS-21	Multi-Grain Aliquot	Plagioclase	125	212	mineral separation

Datapoint Key	Aliquot size	Aliquot size unit	Aliquot comment
TAS-01	10.3	mg	Very fresh plagioclase is angular with not much variation in grain size. Some grains have a very slight gre
TAS-14	10	mg	
TAS-19	8.5	mg	Fresh, typical plagioclase. Angular grains, grain size is variable.
TAS-21	10	mg	Fresh, typical plagioclase. Angular grains, minor variation in grain size.

Aliquot Metadata

Preparation Process

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

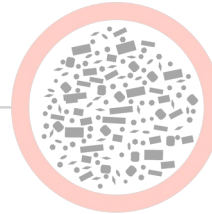


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

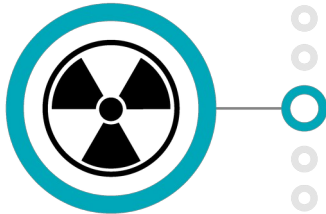
SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
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- acid leaching
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- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

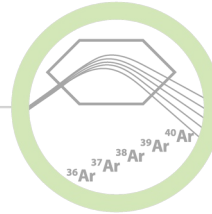


IRRADIATION

2 to 6 months

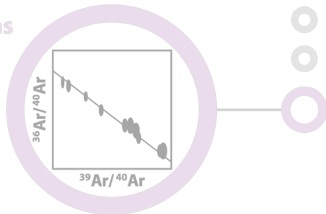
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
- Ar isotope data reduction

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

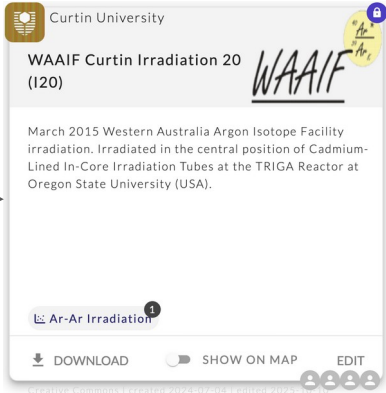


Analytical facility processes samples and records analytical metadata directly into the AuScope EarthBank platform.



Irradiation

Analytical facility records irradiation information in the AuScope EarthBank platform.



Creative Commons | Created 2024-07-04 | Edited 2025-09-24

AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

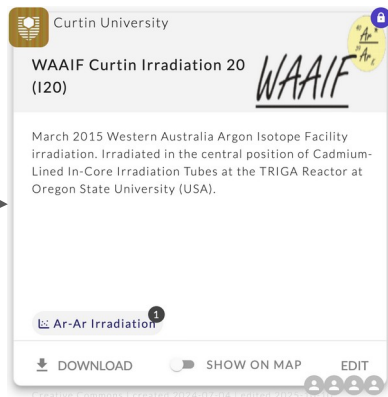
WAAIF ⁴⁰Ar* / ³⁹Ar

Analytical facility processes samples and records analytical metadata directly into the AuScope EarthBank platform.



Irradiation

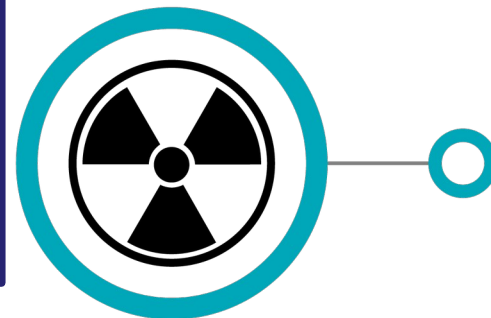
Analytical facility records irradiation information in the AuScope EarthBank platform.



- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ³⁹Ar, ³⁷Ar)

IRRADIATION

2 to 6 months

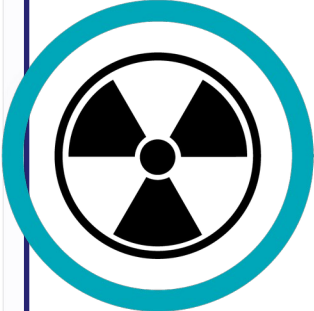


AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

The screenshot shows the EarthBank data entry interface. The left sidebar contains navigation options: Start, Data Packages, Samples, Analytical Data, Meta Data, ArAr SetUp, ArAr Irradiation, ICPMS Metadata, Shared Data, and Deposit Data. The main area is divided into GENERAL, MORE, and FILES tabs. The GENERAL tab is active, showing various input fields for an irradiation record.

Name of this Irradiation	I20	Description	
Irradiation duration	40	Tags	
Irradiation duration units	hr	Data Package *	WAAIF Curtin Irradiation 20 (I20)
Irradiation duration comment			
Reactor name	TRIGA Reactor, Radiation Center, O		
Reactor port	CLICIT		
Irradiation style	standard		
Cadmium shielding	<input checked="" type="checkbox"/>		
(36/37)Ca Interference	0.000265		
Uncertainty	0.0083		
Uncertainty Type	1 sigma		
Uncertainty Unit			
(39/37)Ca Interference	0.000695		
Uncertainty	0.013		

IRRADIATION
2 to 6 months



Geometry of irradiation disks

Nucleogenic isotope production

Co-irradiation w/flux monitor

The screenshot shows an Excel spreadsheet with a table of irradiation data. The table has columns for 'J Value' and 'J Value Uncertainty'. The data is as follows:

	J Value	J Value Uncertainty
1		
2	Float	Float
3	J Value	J Value Uncertainty
4	jValue	jValueUncertainty
5	0.010589	0.06
6	0.010589	0.06
7	0.010589	0.06
8	0.010589	0.06
9	0.010589	0.06
10	0.010589	0.06

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

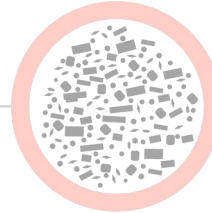


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
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- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

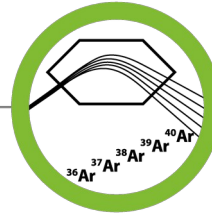


IRRADIATION

2 to 6 months

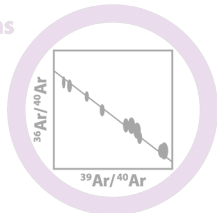
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
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- isochrons
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- ideograms/distribution plots



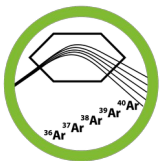
DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

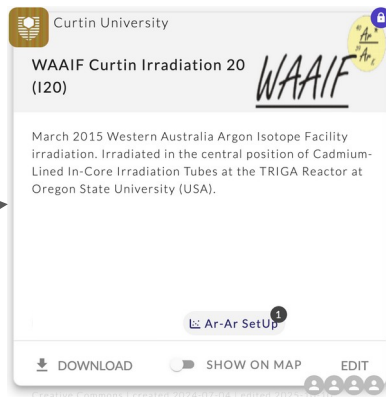
WAAIF ⁴⁰Ar*
³⁹Ar

Analytical facility processes samples and records analytical metadata directly into the AuScope EarthBank platform.



Analytical Set Up

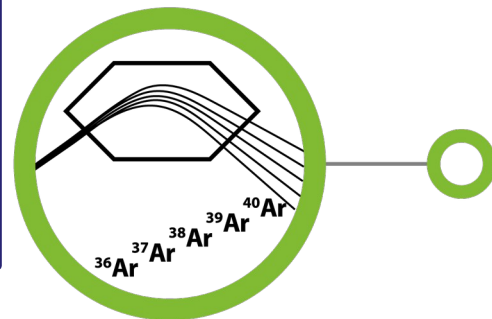
Analytical facility records analytical set up metadata directly into the AuScope EarthBank platform.



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
- Ar isotope data reduction

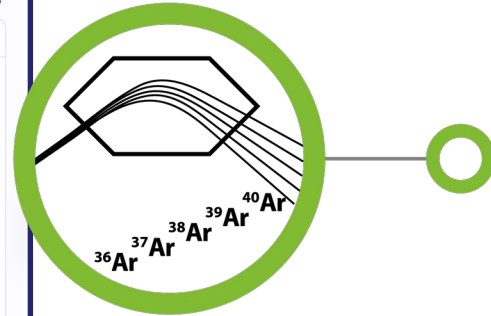
NOBLE GAS ANALYSIS

2 to 6 months



AuScope Ar-Ar Data Pipeline: Workflow – Sample and Analytical Preparation

NOBLE GAS ANALYSIS
2 to 6 months



EarthBank Map Data Data Contributor Help

GENERAL INSTRUMENTS MORE FILES

Name of this SetUp: WAAIF Lab_July 2024

Analytical Method: Step-heating - laser

Laser type: CO2

Furnace type

Ramp heating time: 1

Ramp heating time units

Heating duration: 60

Heating duration units: sec

Experiment design: Normal Plagioclase_4F+CDD

Analysis Name: Plagioclase Step Heating

Mass spectrometer: ARGUS-VI

Mass spectrometer sensitivity: 2.6×10^{17}

Mass spectrometer sensitivity units: mol/IA

Description: Fusion/Step Heating/Laser Ablation

Gas Clean-Up/Purification

Tags

Data Package: WAAIF Curtin Irradiation 20 (I20)

Uncertainty Type: 2 sigma

Air shot frequency: 3

Regression method: Exponential

Data processing software: ArArCALC

Analysis of Air or Cocktail of Standards

Characterization of Blanks and Baselines

AutoSave

Home Insert Draw

Clipboard Font Alignment Number

Comments

Conditional Formatting

Format as Table

Cell Styles

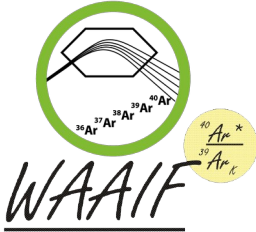
196

	AK	AL	AM	AN	
1	Mass 36 analytical blank value	Analytical uncertainty associated with analysis	Mass 37 analytical blank value	Analytical uncertainty associated with analysis	Ma
2	Float	Float	Float	Float	
3	36Ar blank	Uncertainty	37Ar blank	Uncertainty	
4	ar36blank	ar36blankUncertainty	ar37blank	ar37blankUncertainty	
5	5.87017E-05	1.44247E-06	-1.79992E-05	0.000244489	-0.
6	5.70427E-05	1.44247E-06	5.6344E-05	0.000244489	-0.
7	5.63296E-05	1.44247E-06	8.95613E-05	0.000244489	-0.
8	5.50469E-05	1.44247E-06	0.000152239	0.000244489	-0.
9	5.44851E-05	1.44247E-06	0.000181462	0.000244489	-0.

ArAr Datapoints Measurements Aliquots Age Su +

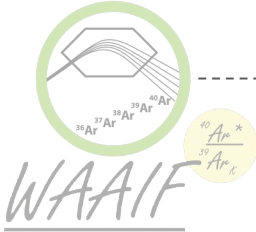
AuScope Ar-Ar Data Pipeline: Workflow – Analysis

Analytical facility performs analyses.

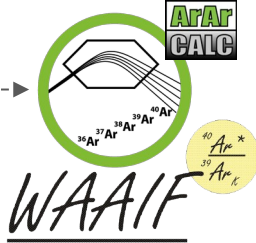


AuScope Ar-Ar Data Pipeline: Workflow – Analysis

Analytical facility performs analyses.

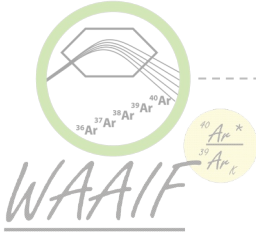


Analytical facility reduces and interprets data.

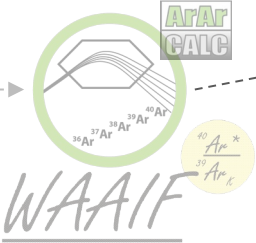


AuScope Ar-Ar Data Pipeline: Workflow – Analysis

Analytical facility performs analyses.



Analytical facility reduces and interprets data.

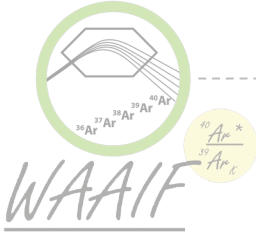


Analytical facility **manually** adds reduced data to the AuScope EarthBank's data template.

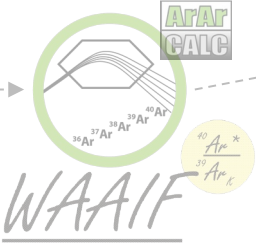


AuScope Ar-Ar Data Pipeline: Workflow – Analysis

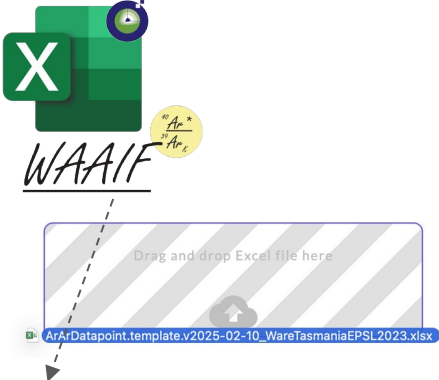
Analytical facility performs analyses.



Analytical facility reduces and interprets data.



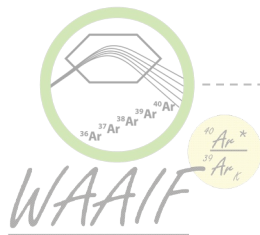
Analytical facility **manually** adds reduced data to the AuScope EarthBank's data template.



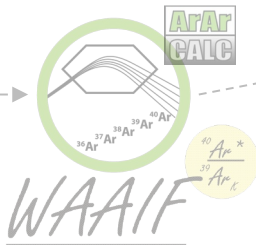
Analytical facility uploads reduced data to the data package.

AuScope Ar-Ar Data Pipeline: Workflow – Analysis

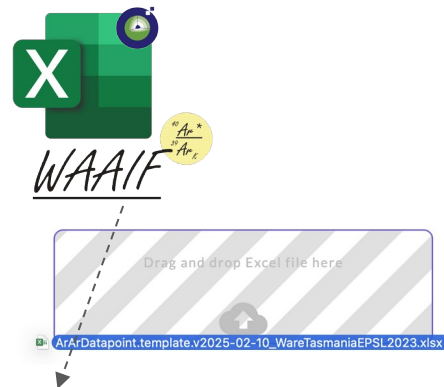
Analytical facility performs analyses.



Analytical facility reduces and interprets data.

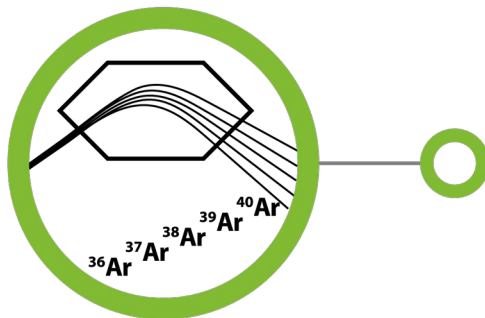


Analytical facility **manually** adds reduced data to the AuScope EarthBank's data template.



- **fusion/step heating/laser ablation**
- **gas clean-up/purification**
- **characterization of blanks and baselines**
- **analysis of air or cocktail standards**
- **Ar isotope data reduction**

NOBLE GAS ANALYSIS 2 to 6 months



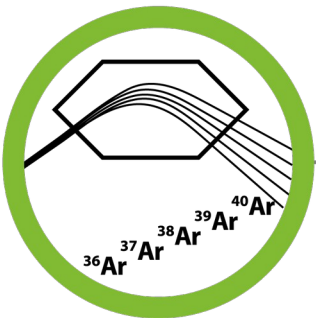
Analytical facility uploads reduced data to the data package.

AuScope Ar-Ar Data Pipeline: Workflow – Analysis

NOBLE GAS ANALYSIS

2 to 6 months

Fusion/Step Heating/Laser Ablation

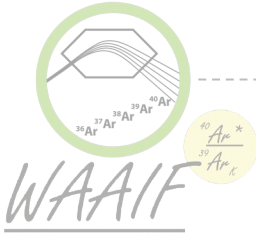


The screenshot shows an Excel spreadsheet titled "ArArDatapoint.template.v2025-02-10_WareTasmaniaEPS...". The spreadsheet contains data for Ar-Ar analysis. The columns are labeled P, Q, R, S, T, U, V, W, X. The rows represent different isotopes and their associated uncertainties. A diagram from the left points to specific cells in the spreadsheet.

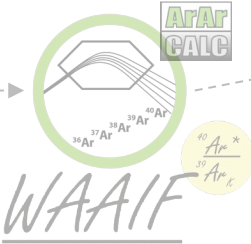
	P	Q	R	S	T	U	V	W	X
1	36Ar corrected for mass discrimination and interferences	Analytical uncertainty associated with analysis	37Ar corrected for mass discrimination and decay	Analytical uncertainty associated with analysis	38Ar corrected for mass discrimination and interferences	Analytical uncertainty associated with analysis	39Ar corrected for mass discrimination, decay, and	Analytical uncertainty associated with analysis	40Ar corrected for mass discrimination and interferences (=40Ar* +
2	Float	Float	Float	Float	Float	Float	Float	Float	Float
3	36Ar (corrected)	Uncertainty	37Ar (corrected)	Uncertainty	38Ar (corrected)	Uncertainty	39Ar (corrected)	Uncertainty	40Ar (corrected)
4	ar36Corr	ar36CorrUncertainty	ar37Corr	ar37CorrUncertainty	ar38Corr	ar38CorrUncertainty	ar39Corr	ar39CorrUncertainty	ar40Corr
5	-5.32525E-07	282.4878048	0.000399418	223.4970174	1.66221E-05	119.1753941	1.1193E-05	312.4744323	5.15728E-05
6	-3.99176E-07	382.6787565	0.000801083	111.5212501	3.89754E-06	576.8111795	3.73905E-05	93.91492544	0.000218338
7	1.24334E-05	12.23423122	0.019024949	4.705133319	4.6464E-05	42.2017107	0.00080995	4.320633308	0.010077435
8	0.000152994	0.034570182	0.234910477	0.440440203	0.000165295	12.32064608	0.01029164	0.350154008	0.128890034
9	0.000347093	0.571357043	0.612884625	0.265116894	0.00039153	5.392301306	0.02655506	0.145382469	0.317009163
10	0.000392902	0.476037215	0.923383206	0.241693785	0.000524438	3.907025198	0.03978144	0.108863408	0.442551857
11	0.000413807	0.472626568	1.167592294	0.234415616	0.000647361	3.565623726	0.049771417	0.094888823	0.529892707
12	0.000424565	0.459181301	1.268945135	0.232658984	0.000698166	3.279027504	0.054282424	0.092258763	0.565278702
13	0.000385434	0.559729624	1.216618217	0.233454267	0.000674628	2.820698528	0.051478828	0.093088566	0.528696922
14	0.00038163	0.566260213	1.206040086	0.233755076	0.000680352	2.954277879	0.051196552	0.09415519	0.528282673
15	0.000334748	0.559440553	1.049027656	0.237448227	0.0005624	3.4696802	0.045067706	0.099143929	0.464738998
16	0.000316237	0.563895026	0.979770313	0.239668871	0.000513784	3.338870139	0.041752133	0.105497965	0.43251767
17	0.000409629	0.519443007	1.249549189	0.232890964	0.000680882	2.935096574	0.053246289	0.089051291	0.551329395
18	0.000350758	0.536935017	1.091468264	0.236324875	0.000588585	3.298714094	0.046470847	0.097410499	0.478266707
19	0.000459645	0.451709548	1.378555464	0.231080956	0.000756796	2.416738889	0.05980007	0.087888181	0.624755872
20	0.000398083	0.604837559	1.263641425	0.232706883	0.000622271	3.79210435	0.050006007	0.09546788	0.513592875
21	0.000370055	0.664373874	0.872904242	0.243441463	0.000414368	5.266890344	0.123298275	0.230846467	0.1056

AuScope Ar-Ar Data Pipeline: Workflow – Analysis

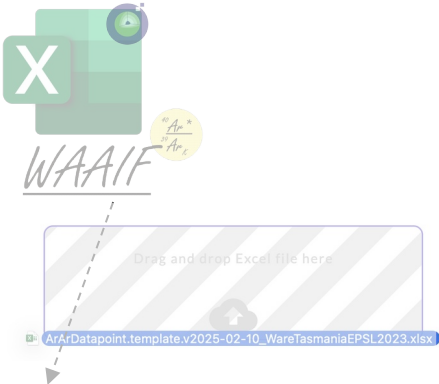
Analytical facility performs analyses.



Analytical facility reduces and interprets data.



Analytical facility **manually** adds reduced data to the AuScope EarthBank's data template.



Curtin University Australia

Tasmanian Dolerite

One of the most impassioned topics in large igneous province (LIP) research is how prolonged the duration of these large-scale magmatic events are, as LIP magmatism has considerable impact on models of associated reconstructions of climate variability or tectonic events. High-precision geochronology is pivotal to LIP basalt emplacement rate, and thus to unravel the role these enormous magmatic events have throughout Earth's

Samples 17 Ar-Ar 25 Ar-Ar Irradiation 3 Ar-Ar SetUp 1

DOWNLOAD SHOW ON MAP MORE

Analytical facility associates irradiation and instrument set-up metadata to the data package.



Curtin University Australia

Tasmanian Dolerite

One of the most impassioned topics in large igneous province (LIP) research is how prolonged the duration of these large-scale magmatic events are, as LIP magmatism has considerable impact on models of associated reconstructions of climate variability or tectonic events. High-precision geochronology is pivotal to LIP basalt emplacement rate, and thus to unravel the role these enormous magmatic events have throughout Earth's

Samples 17 Ar-Ar 25

WAAIF

DOWNLOAD SHOW ON MAP MORE

Analytical facility uploads reduced data to the data package.

$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

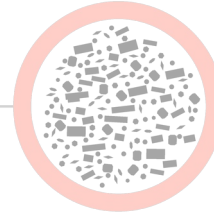


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

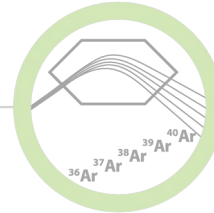


IRRADIATION

2 to 6 months

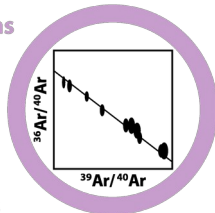
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
- gas clean-up/purification
- characterization of blanks and baselines
- analysis of air or cocktail standards
- Ar isotope data reduction

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation

Additional files required for publication/provide additional information can be attached to the data package

The screenshot shows a data package interface for 'Tasmanian Dolerite' from Curtin University, Australia. It includes a title, a descriptive paragraph, and a list of data items with counts: Samples (17), Ar-Ar (25), Ar-Ar Irradiation (3), Ar-Ar SetUp (1), and Files (3). At the bottom, there are buttons for 'DOWNLOAD', 'SHOW ON MAP', and 'MORE'. A yellow circular sticker with the text 'Ar-Ar' is overlaid on the 'DOWNLOAD' button.

WAAIF

AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation

Additional files required for publication/provide additional information can be attached to the data package

Curtin University Australia

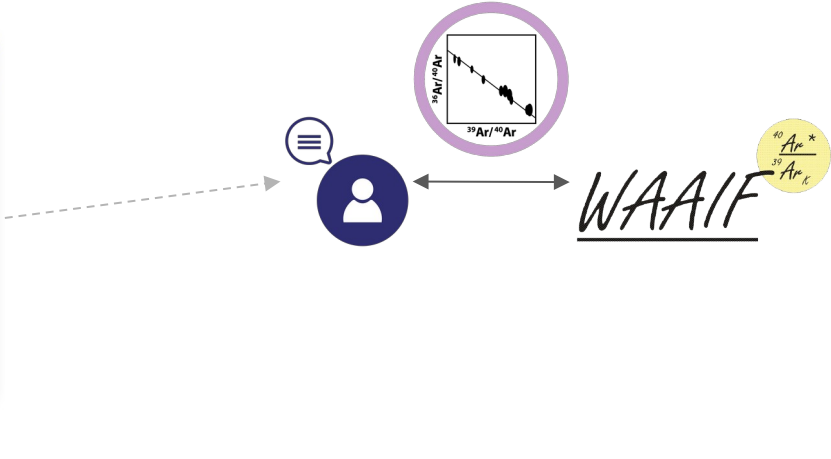
Tasmanian Dolerite

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17 Samples 25 Ar-Ar 3 Ar-Ar Irradiation 1 Ar-Ar SetUp 3 Files

DOWNLOAD SHOW ON MAP MORE

Researcher/client interpret the data with the analytical facility



AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation



EarthBank
I want to...
Map Data Data Contributor Help

- Data
- Analytical Layers
- Select Area
- Tools
- Basemaps
- Map View
- Overlays
- Location Type
- Rock Type
- Elevation
- Age
- Analysis Scale

TAS-14 Curtin University

Sample data

Analytical data: TAS-14\\2025-10-19 #2

Analytical Plots: TAS-14\\2025-10-19 #2

Weighted Mean Age Spectrum Inverse Isochron

Mean: 182.65 ± 0.5 Myr

Cumulative ³⁹ Ar Percent (%)	Age (Ma)
67.5	182.74 ± 1.8

300 km
-27.751, 181.085
-4020m

AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation



EarthBank I want to...

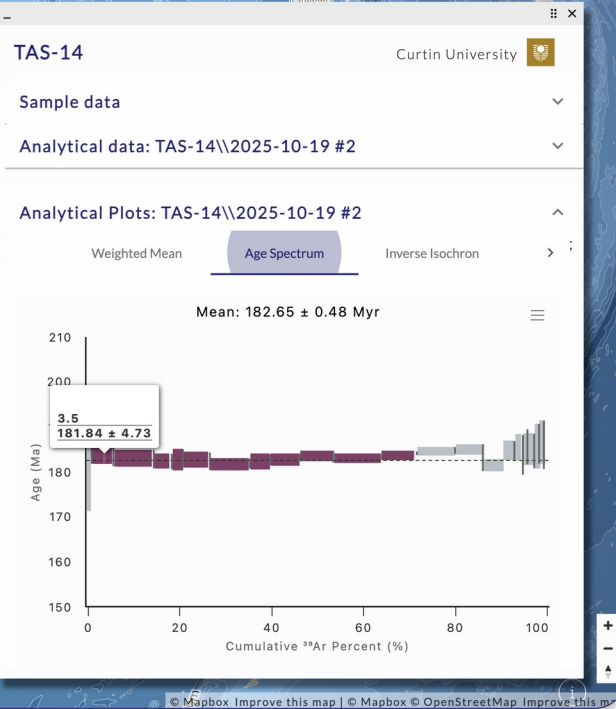
- Data
- Analytical Layers
- Select Area
- Tools
- Basemaps
- Map View
- Overlays
- Location Type
- Rock Type
- Elevation
- Age
- Analysis Scale

300 km
-27.751, 181.085
mapbox -4020m

EarthBank I want to...

- Data
- Analytical Layers
- Select Area
- Tools
- Basemaps
- Map View
- Overlays
- Location Type
- Rock Type
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300 km
-27.751, 181.085
mapbox -4020m

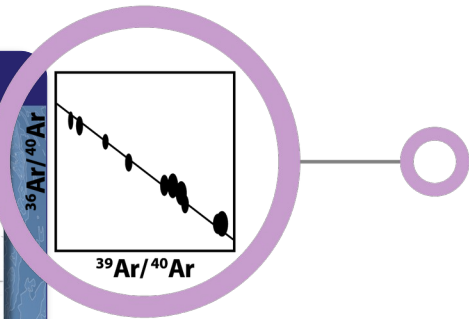
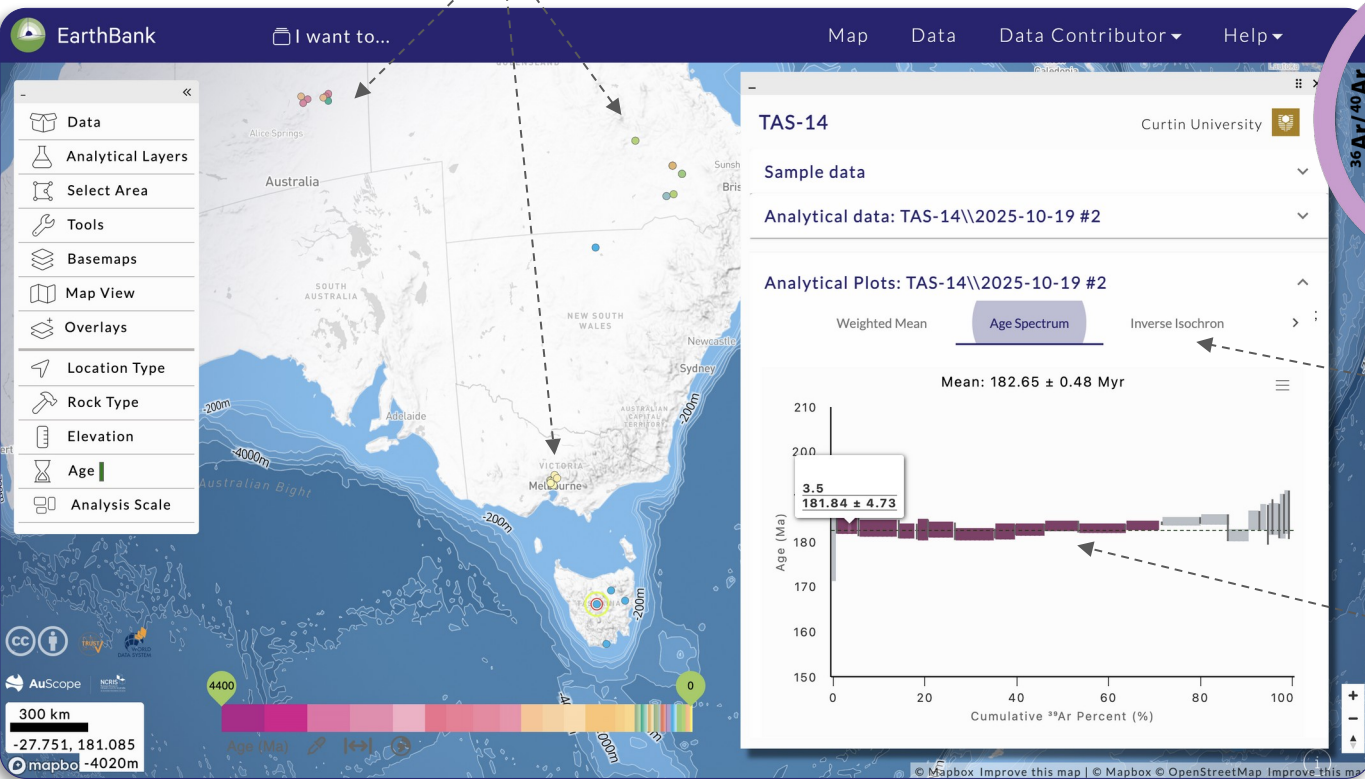


AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation

DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

Apparent Age Maps

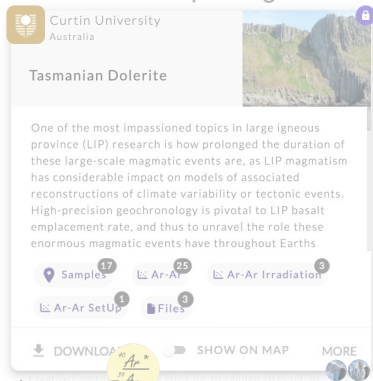


Isochrons

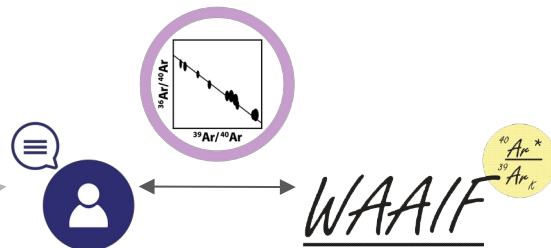
Release Spectra

AuScope Ar-Ar Data Pipeline: Workflow – Data Interpretation

Additional files required for publication/provide additional information can be attached to the data package



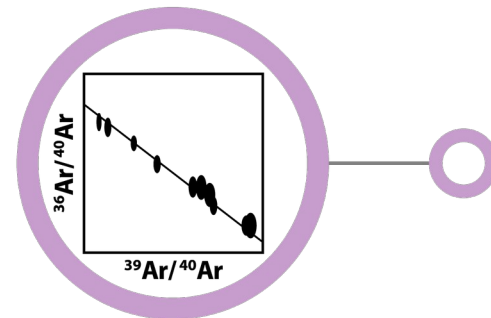
Researcher/client interpret the data with the analytical facility



DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



AuScope Ar-Ar Data Pipeline: Workflow – Data Delivery

Additional files required for publication/provide additional information can be attached to the data package

Curtin University
Australia

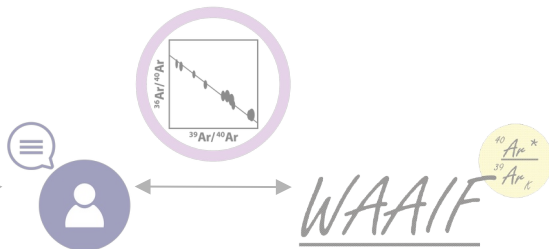
Tasmanian Dolerite

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📍 Samples 17 📄 Ar-Ar 25 📄 Ar-Ar Irradiation 3
📄 Ar-Ar SetUp 1 📄 Files 3

📄 DOWNLOAD 🗺️ SHOW ON MAP MORE

Researcher/client interpret the data with the analytical facility



Easy download of all samples and analytical metadata, and analytical results

Curtin University
Australia

Tasmanian Dolerite ~1.6 Ma Duration

Data and attached supplementary files for "The Ferrar Continental Flood Basalt: A ~1.6 Ma long duration evidenced by high-precision $^{40}\text{Ar}/^{39}\text{Ar}$ ages suggest a potential role in the Pliensbachian-Toarcian extinction event" Ware et al. (2023)
<https://doi.org/10.1016/j.jepsl.2023.118369>

One of the most impassioned topics in large igneous

📍 Samples 17 📄 Ar-Ar 25 📄 Ar-Ar Irradiation 3
📄 Ar-Ar SetUp 1 📄 Files 3

📄 DOWNLOAD 🗺️ SHOW ON MAP MORE

DOWNLOAD

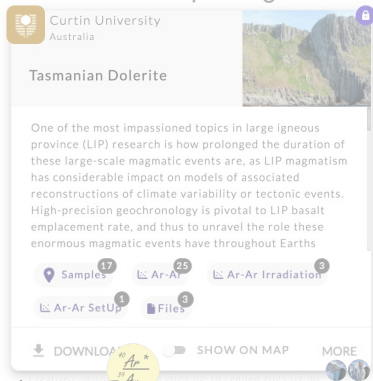
You can download a ZIP file generated on 2025-02-17.
The file is up-to-date.

📄 DOWNLOAD

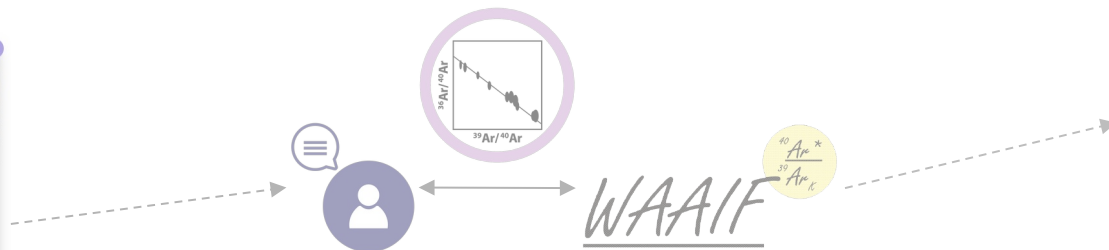
MORE OPTIONS...

AuScope Ar-Ar Data Pipeline: Workflow – Data Delivery

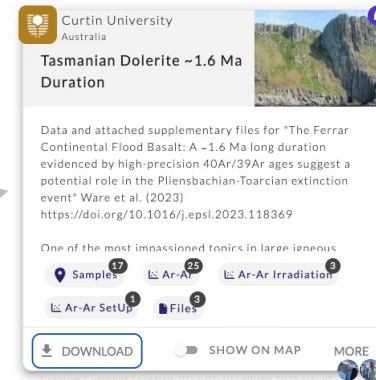
Additional files required for publication/provide additional information can be attached to the data package



Researcher/client interpret the data with the analytical facility



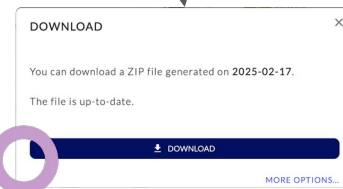
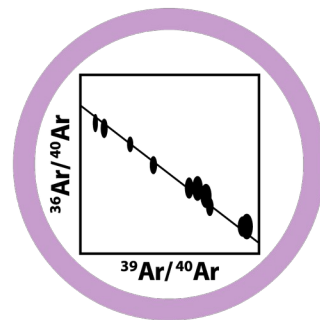
Easy download of all samples and analytical metadata, and analytical results



DATA INTERPRETATION/OPEN SOURCE ARCHIVE

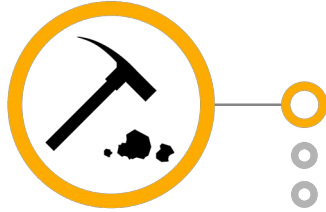
1 to 3 weeks

- isochrons
- chemical correlation diagrams
- release spectra
- apparent age maps
- statistical analysis
- ideograms/distribution plots



$^{40}\text{Ar}/^{39}\text{Ar}$ Dating Workflow and Timeline

- lithology
- latitude
- longitude
- altitude
- geologic context

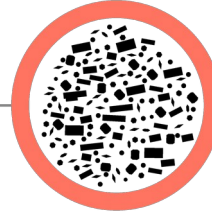


OUTCROP/EXTRATERRESTRIAL SAMPLING

1 to 10 weeks

SAMPLE PREPARATION

1 to 3 weeks



- petrologic characterization
- polished section preparation
- bulk crush/sieve
- gravity/density/magnetic sorting
- acid leaching
- hand-picking of K-rich phases

- geometry of irradiation disks or quartz tubes
- co-irradiation w/flux monitor
- nucleogenic isotope production: (e.g. ^{39}Ar , ^{37}Ar)

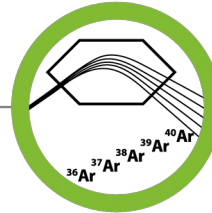


IRRADIATION

2 to 6 months

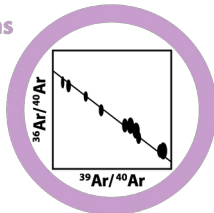
NOBLE GAS ANALYSIS

1 to 4 weeks



- fusion/step heating/laser ablation
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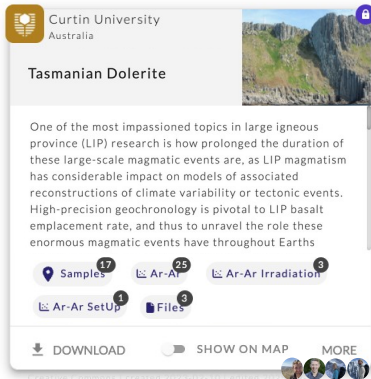
DATA INTERPRETATION/OPEN SOURCE ARCHIVE

1 to 3 weeks

TOTAL TIME : 3-12 months

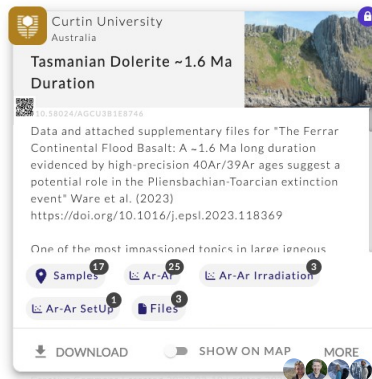
AuScope Ar-Ar Data Pipeline: Workflow – Data Dissemination

Additional collaborators can be added to the data package in preparation for manuscript drafting and publication



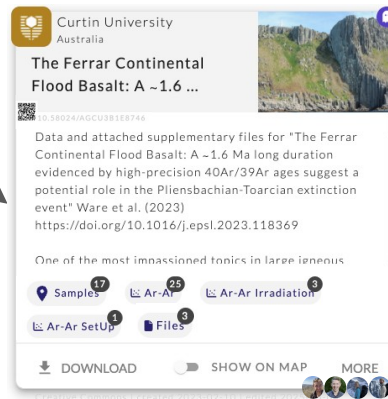
Publication Preparation

A DOI can be minted to the data package in preparation for manuscript publication



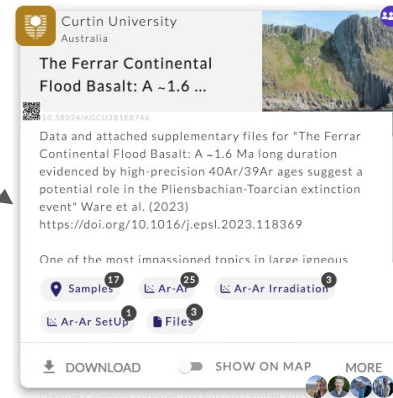
Publication Review

The 'Review' setting provides the ability for the data package and data within to be viewed during the manuscript review process



Data Set Publication

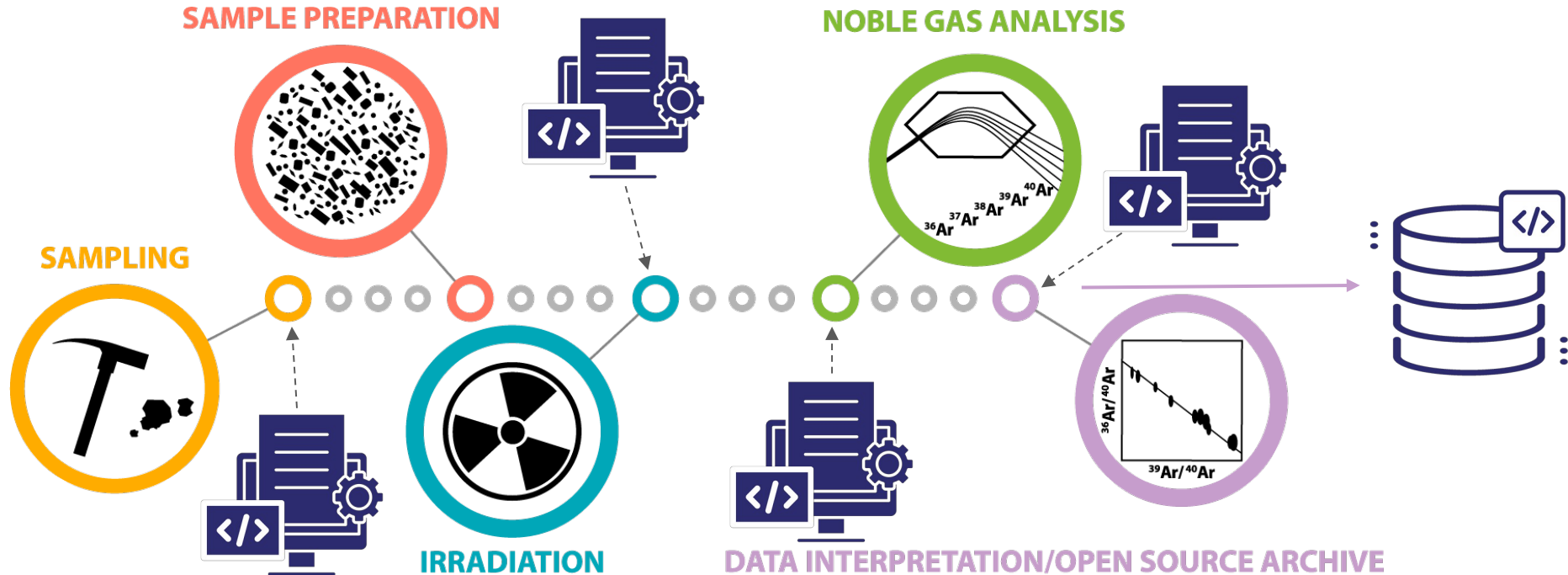
With a data set-specific DOI, the data package can be made public on the AuScope EarthBank platform once manuscript is published



AuScope Geochemistry Network initiatives

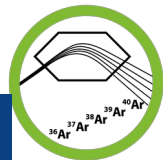
Automated, open-source data capture

- Tools (Pychron) for direct upload to trusted repositories (AuScope Data Repository, EarthBank).

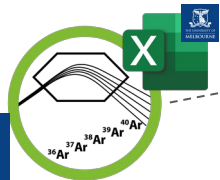


AuScope Ar-Ar Data Pipeline: Workflow – Analysis

Analytical facility performs analyses.



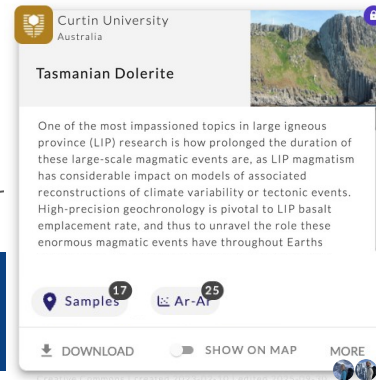
Analytical facility reduces and interprets data.



Analytical facility **manually** adds reduced data to the AuScope EarthBank's data template.



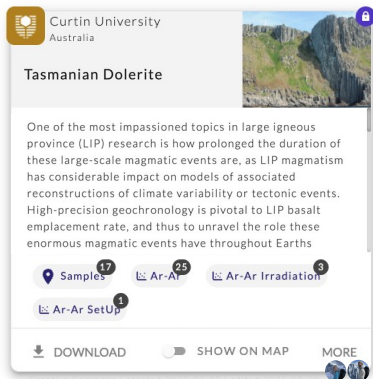
Noble Gas Geochronology



Noble Gas Geochronology

Analytical facility uploads reduced data to the data package.

Analytical facility **manually** input irradiation and instrument set-up metadata to the data package.



Noble Gas Geochronology



AuScope Ar-Ar Data Pipeline: Workflow – open-source, automated data capture tools

Updating Rock Dating with Pychron

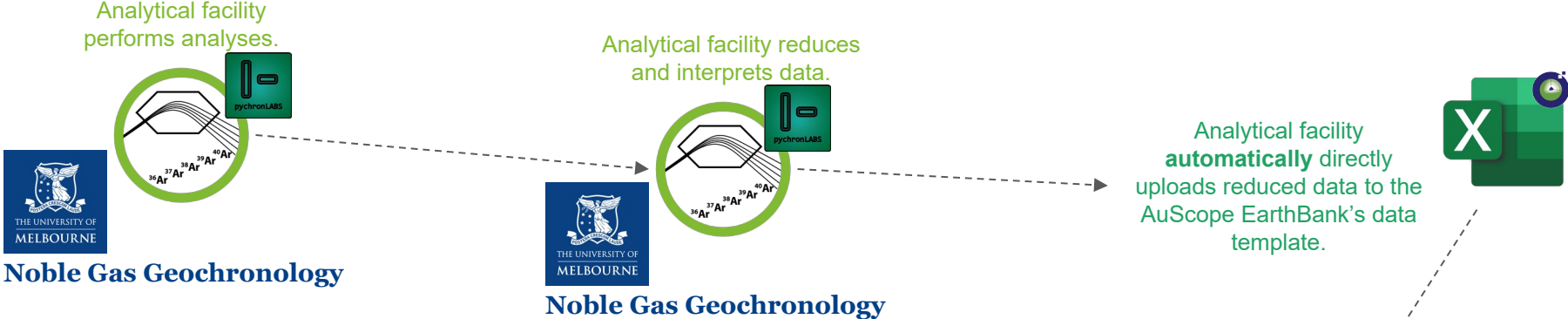


AuScope



In 2024 (Started August 2025) AuScope awarded an Opportunity Fund to update outdated software across Ar-Ar laboratories in Australia to a unified open-source platform, enabling long-term accessibility, adaptability, and international compatability.

AuScope Ar-Ar Data Pipeline: Workflow – open-source, automated data capture tools



The University of Melbourne
Australia

Basalt lava flows of the intraplate Newer Vo...

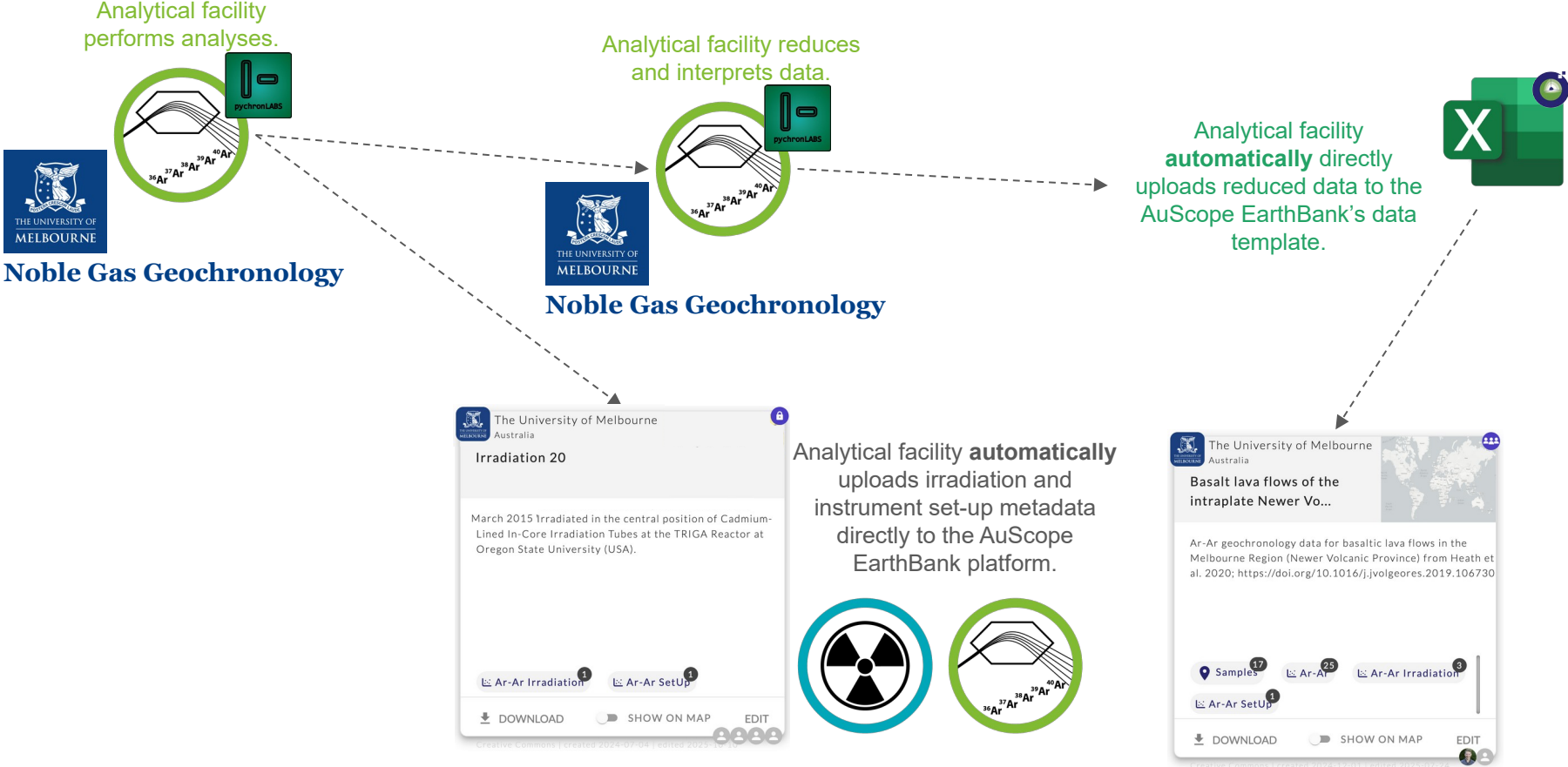
Ar-Ar geochronology data for basaltic lava flows in the Melbourne Region (Newer Volcanic Province) from Heath et al. 2020; <https://doi.org/10.1016/j.jvolgeores.2019.106730>

Samples 17 Ar-Ar 20 Ar-Ar Irradiation 3 Ar-Ar SetUp 1

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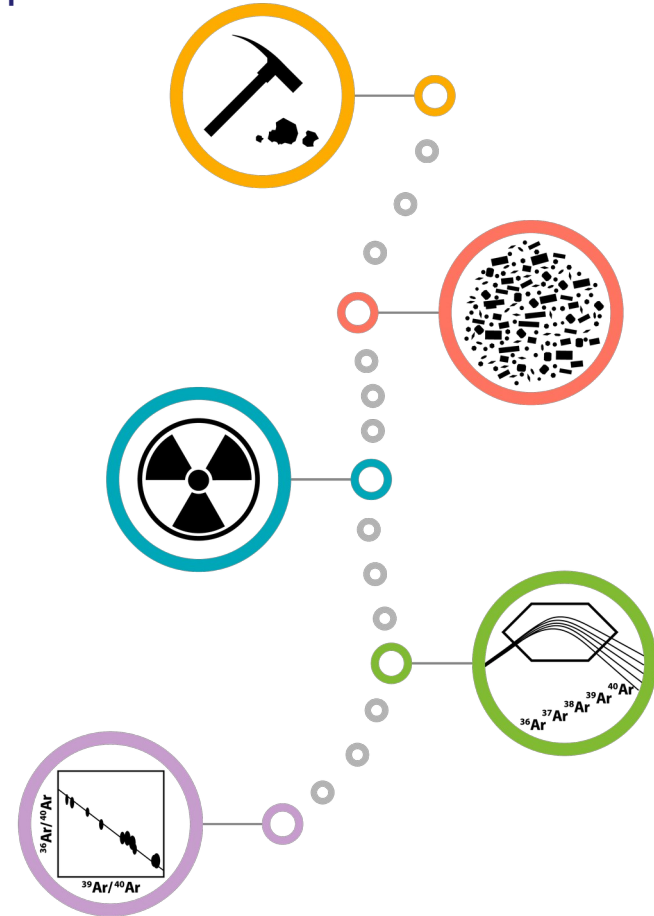
Creative Commons | created 2024-12-01 | edited 2025-07-24

AuScope Ar-Ar Data Pipeline: Workflow – open-source, automated data capture tools



AuScope Ar-Ar Data Pipeline: Workflow – Outcomes & impact

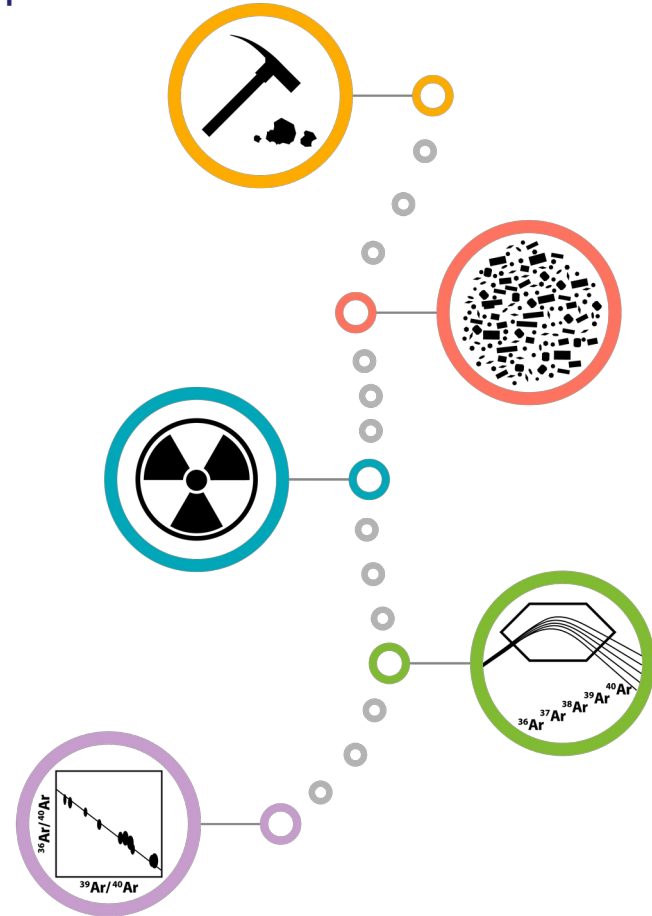
- Makes $^{40}\text{Ar}/^{39}\text{Ar}$ data more accessible, reusable, and Open Science-aligned.
- Strengthens digital infrastructure at the point of data generation.
- Supports more transparent, efficient, and collaborative geoscience research.



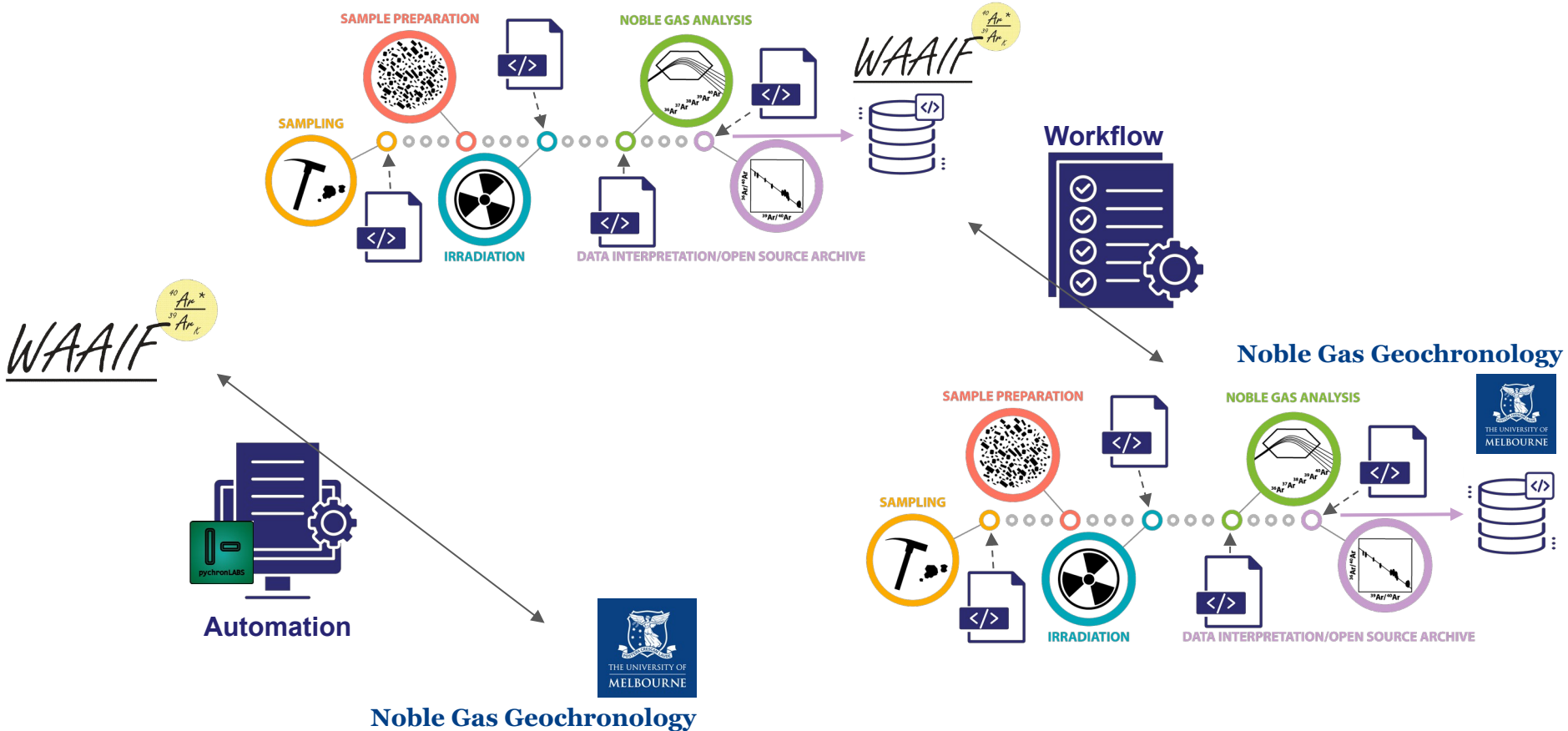
AuScope Ar-Ar Data Pipeline: Workflow – Outcomes & impact

- Makes $^{40}\text{Ar}/^{39}\text{Ar}$ data more accessible, reusable, and Open Science-aligned.
- Strengthens digital infrastructure at the point of data generation.
- Supports more transparent, efficient, and collaborative geoscience research.

Next steps...



AuScope Ar-Ar Data Pipeline: Cross-institution knowledge sharing



AuScope Ar-Ar Data Pipeline: Workflow – Data Delivery

Data is delivered to researcher/client through the AuScope EarthBank platform

Curtin University Australia

Tasmanian Dolerite

One of the most impassioned topics in large igneous province (LIP) research is how prolonged the duration of these large-scale magmatic events are, as LIP magmatism has considerable impact on models of associated reconstructions of climate variability or tectonic events. High-precision geochronology is pivotal to LIP basalt emplacement rate, and thus to unravel the role these enormous magmatic events have throughout Earth's

Samples Ar-Ar Ar-Ar Irradiation

Ar-Ar SetUp

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Additional files required for publication/provide additional information can be attached to the data package

Curtin University Australia

Tasmanian Dolerite

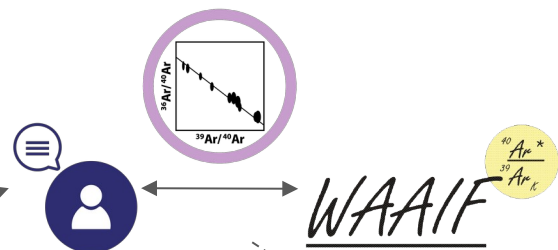
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Samples Ar-Ar Ar-Ar Irradiation

Ar-Ar SetUp Files

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Researcher/client interpret the data with the analytical facility



Easy download of all samples and analytical metadata, and analytical results

WAAIF

WAAIF

Sample	Coordinate	Material	Phase	Sample Type	Method	Isotopes	Sparging	Age	Age Error
1545-1	-45.000000	146.000000	Plagioclase	1545.1A.1	MSD/3	40Ar, 39Ar	100%	1545.1A.1	± 0.5
1545-2	-45.000000	146.000000	Plagioclase	1545.1A.2	MSD/3	40Ar, 39Ar	100%	1545.1A.2	± 0.5

Sample	Coordinate	Material	Phase	Sample Type	Method	Isotopes	Sparging	Age	Age Error
1545-1	-45.000000	146.000000	Plagioclase	1545.1A.1	MSD/3	40Ar, 39Ar	100%	1545.1A.1	± 0.5
1545-2	-45.000000	146.000000	Plagioclase	1545.1A.2	MSD/3	40Ar, 39Ar	100%	1545.1A.2	± 0.5

DOWNLOAD

You can download a ZIP file generated on 2025-02-17.

The file is up-to-date.

[DOWNLOAD](#)

[MORE OPTIONS...](#)

Curtin University Australia

Tasmanian Dolerite ~1.6 Ma Duration

Data and attached supplementary files for "The Ferrar Continental Flood Basalt: A ~1.6 Ma long duration evidenced by high-precision 40Ar/39Ar ages suggest a potential role in the Pliensbachian-Toarcian extinction event" Ware et al. (2023)
<https://doi.org/10.1016/j.epsl.2023.118369>

One of the most impassioned topics in large igneous province (LIP) research is how prolonged the duration of these large-scale magmatic events are, as LIP magmatism has considerable impact on models of associated reconstructions of climate variability or tectonic events. High-precision geochronology is pivotal to LIP basalt emplacement rate, and thus to unravel the role these enormous magmatic events have throughout Earth's

Samples Ar-Ar Ar-Ar Irradiation

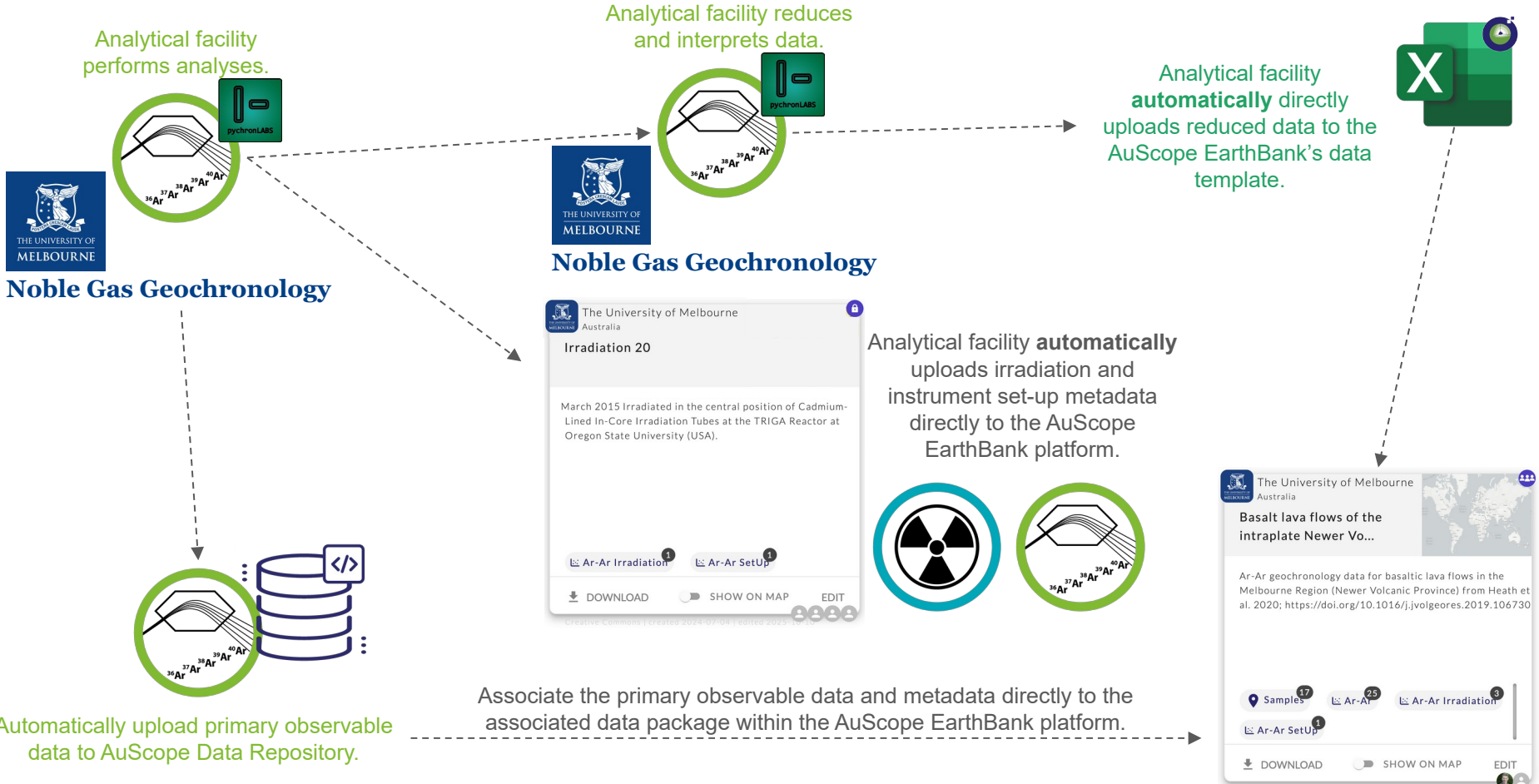
Ar-Ar SetUp Files

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In Development

Formatted publication-ready tables included in the download

AuScope Ar-Ar Data Pipeline: Workflow – open-source, automated data capture tools



Thank You

On behalf of the AuScope Geochemistry Network (AGN) and the EarthBank Project

Contact Us:



earthbank.hq@curtin.edu.au



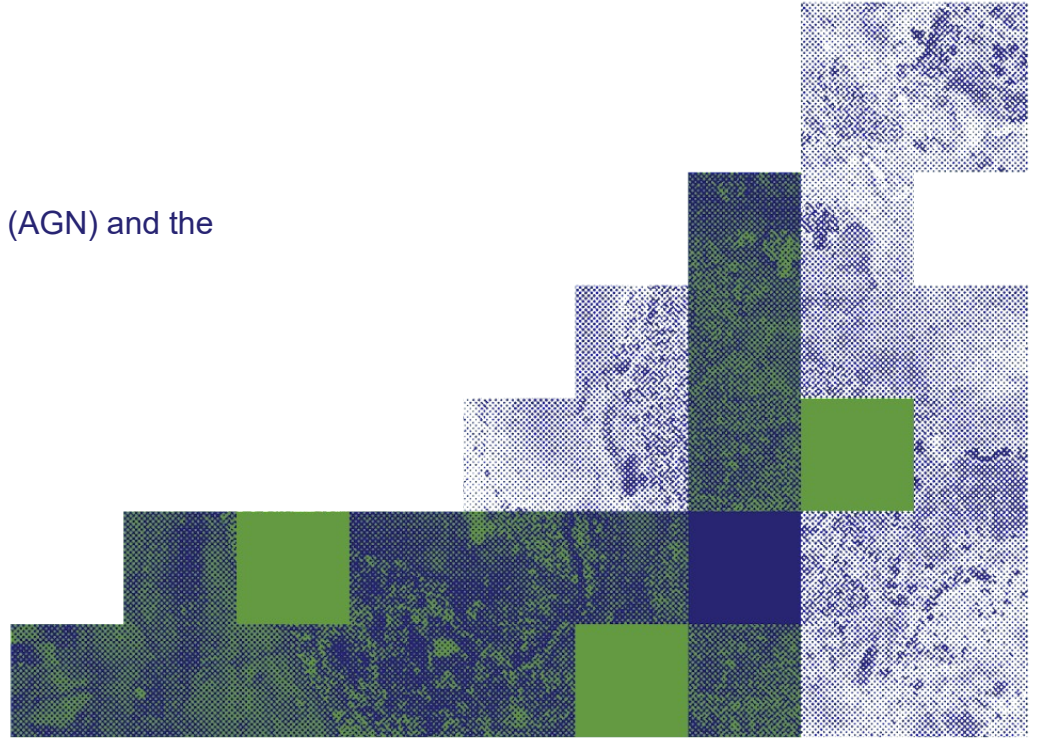
auscope.org.au/earthbank



AuScope EarthBank Project



AuScope Geochemistry Network



AuScope



NCRIS
National Research
Infrastructure for Australia
An Australian Government initiative



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How and where are you preserving your raw machine observable data for future science?

Please stay for our Birds of a Feather session.

Room: Boulevard B1

Time: 14:30 – 16:00

Session Organisers/Presenters:

Angus Nixon | University of Adelaide

Bryant Ware | Curtin University

Lesley Wyborn | Australian National University

Session Presenters:

Simon Hodson | CODATA

Kelsey Druken | Australian National University

