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Evidence for and significance of the Late Cretaceous Asteroussia event in the Gondwanan Ios basement terranes

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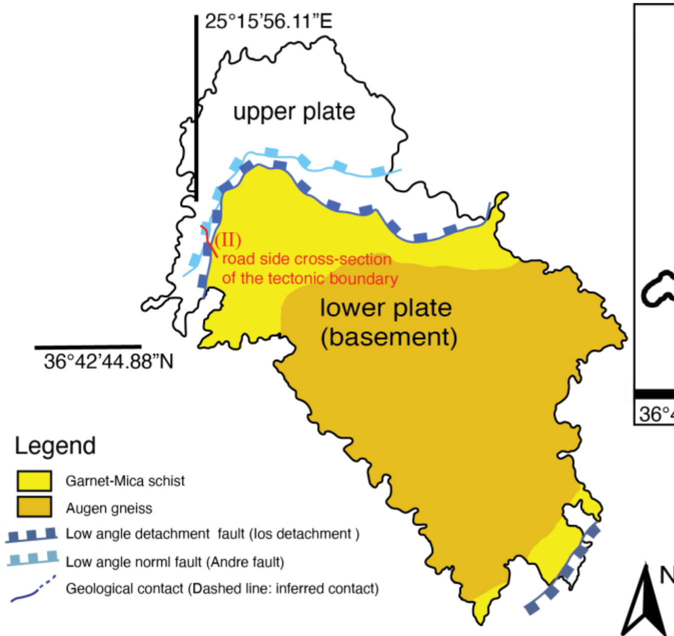
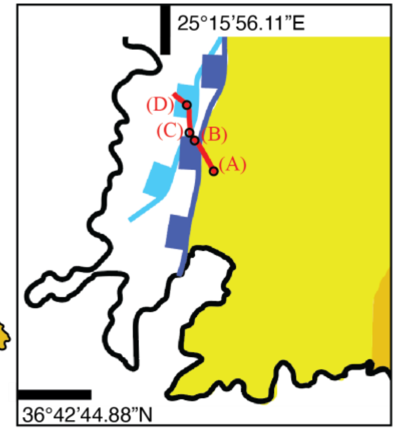
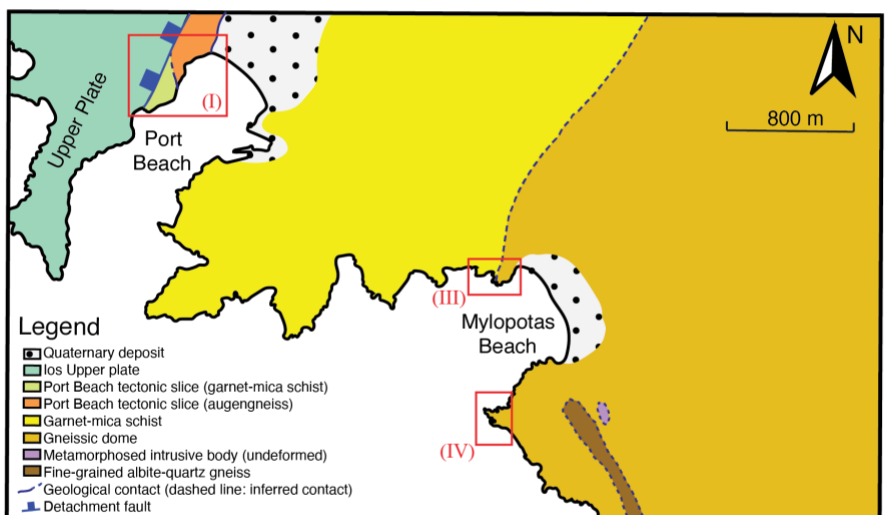
Supplementary materials – Structural Geological Maps in the three field localities.

Maps modified from Yeung, 2019 (Figure 3 in this paper). Enlarged area provide more details to schematic cross-sections in (II**).**



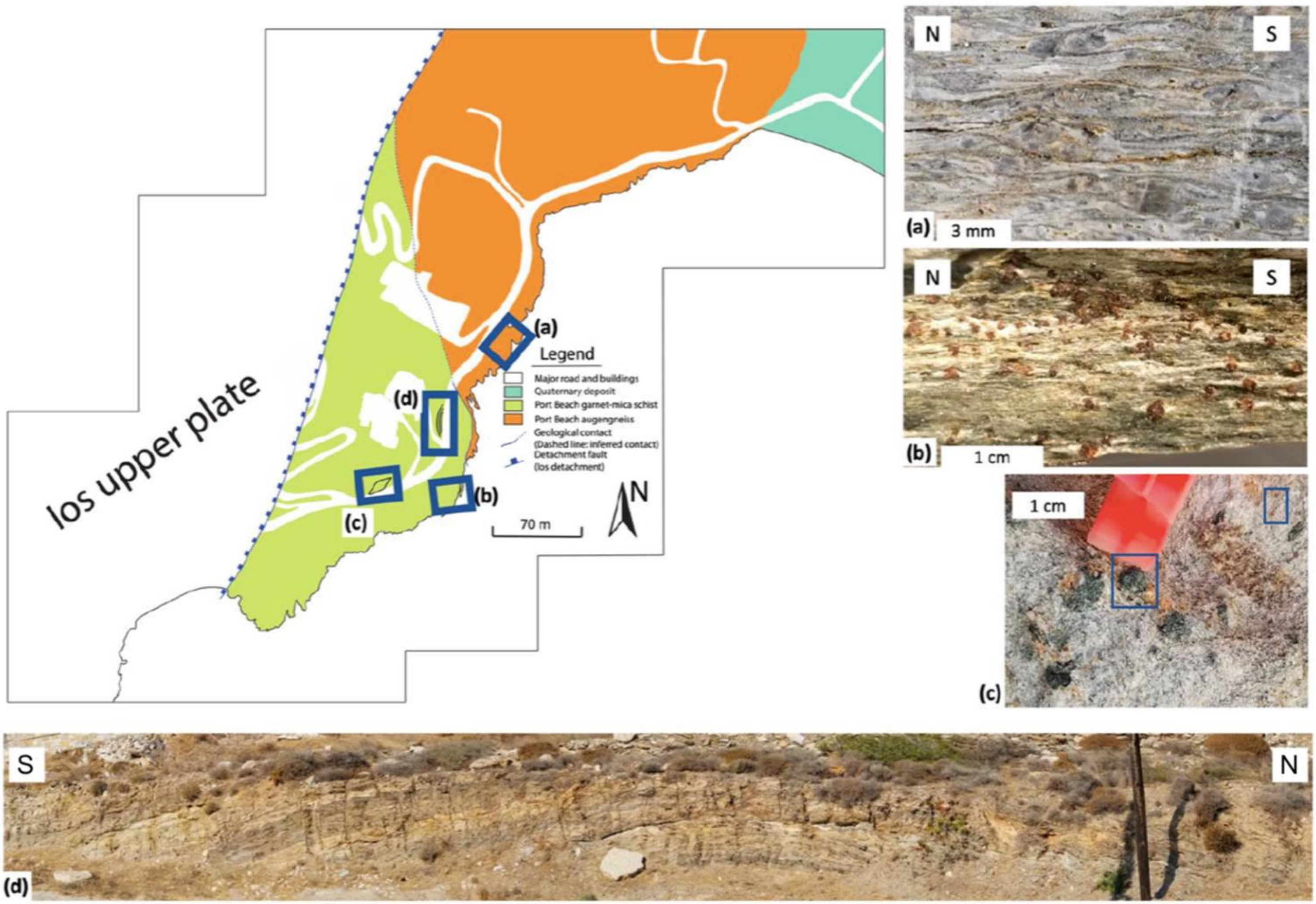


Map after Forster and Lister 2009



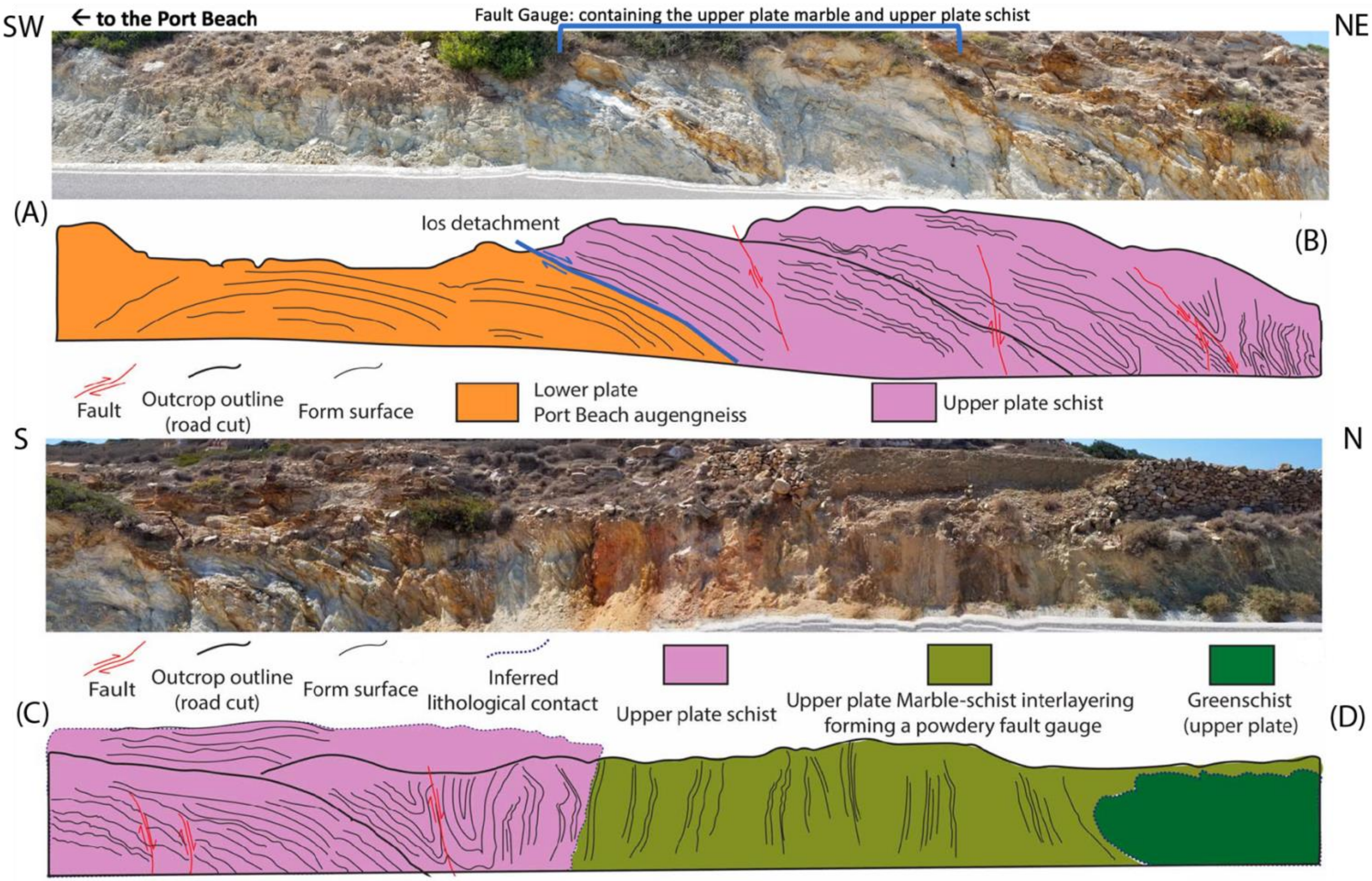
Modified from Yeung 2019

(I) Structural map of the Port Beach tectonic slice. Map from Yeung, 2019

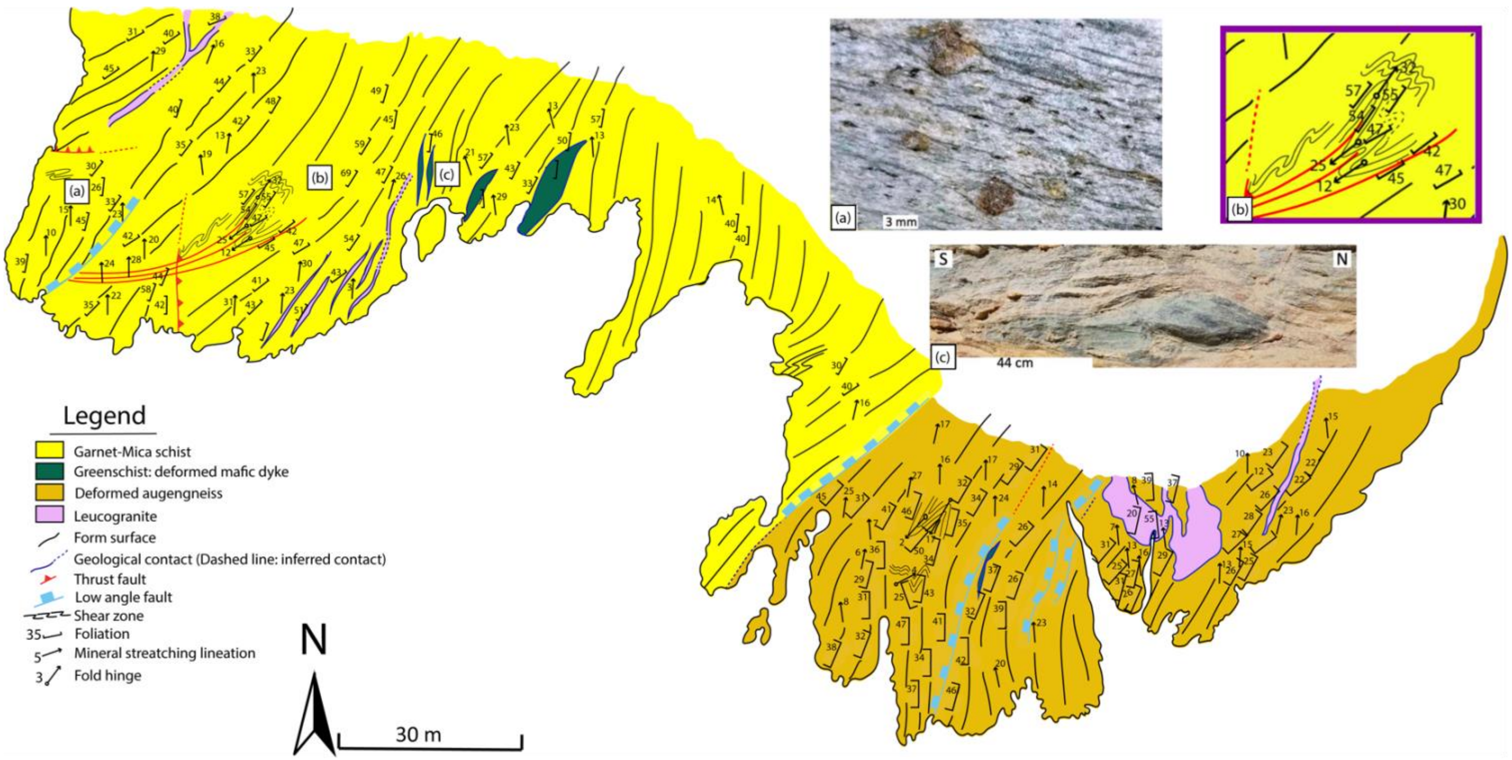


(a) Mylonite augengneiss displaying prominent S-C bands (sample IO18-01). (b) Garnet-mica schist with centimetre thick white mica enriched shear bands and quartz mantle in pressure shadows of garnet porphyroclasts. (c) Altered garnet-mica schist with chlorite replacing the garnet, the crystal “maintains” the shape of the garnet porphyroblast. (d) A folded graphitic quartzite in the road-side outcrop of this tectonic slice.

(II) Structural cross-section of the Port Beach tectonic slice, the schematic cross-sections is directly underneath the photograph of the location. Note that there is a change in cross-section orientation due to the road. The garnet-mica schist lithology is not observed along this road cross-section. Diagram from Yeung, 2019.

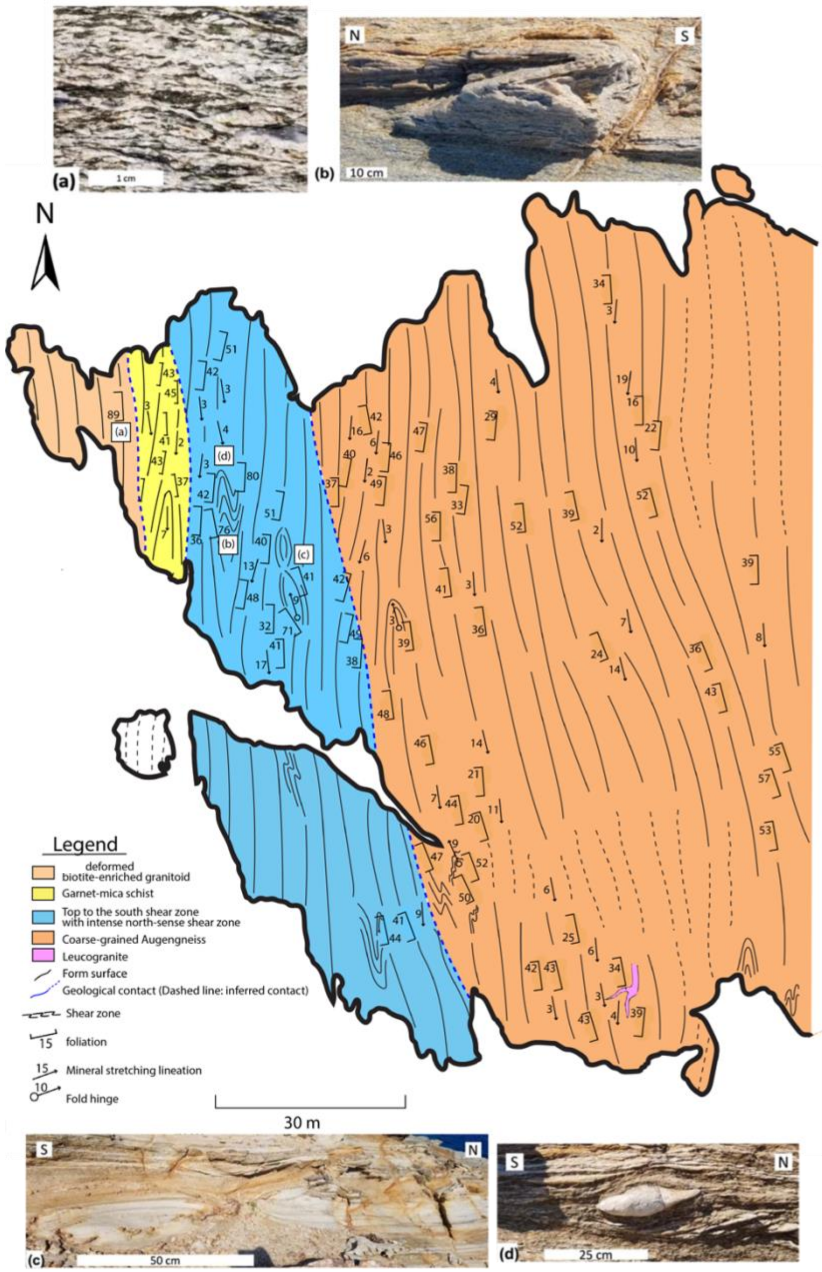


(III) Structural map of the North Mylopotas Headland, where the structurally lowest part of the mid-level garnet-mica schist outcropped. Map from Yeung, 2019.



(a) Mylonite garnet-mica schist displaying prominent S-C' deformation fabrics. (b) Detailed mapping on parasitic folds in the fold hinge of a large anticlinorium. (c) Metabasite deformed into lens-shaped pockets that are deformed by the south-directed shear zone. This deformation structure is in the fold limb of the large anticlinorium with hinge structure preserved.

(IV) Structural map of the South Mylopotas Headland. Complex deformation history is observed in this particular locality. Observations documented in figure 4 are collected from this locality to compare with the result reported in Vandenberg and Lister 1996, using the traditional numbering system on the same locality. Map modified from Yeung, 2019.



(a) Mylonite fabric of the localised intense north-sense shear zone. (b) Isoclinal folds in the north-directed shear zone. (c) Boudinage fold limb of the recumbent fold in the north-sense shear zone. (d) Leucogranite pocket deformed by the latest intense north-sense shear zone.

Supplementary materials – Electron microprobe analysis (EPMA) results.

The EMPA analysis was performed in the Centre of Advanced Microscopy (CAM) in the Australian National University. Detailed methodology and sample analyses are presented in Yeung, 2019. This supplementary section provides analytical results and back-scattered images of microstructures presented and discussed in this paper. values corrected to two decimal places (with the exception of TiO_2 in 2 significant figures).

(IV) EPMA analysis on Port Beach augengneiss (IO18-01)

a. Analysis on three white mica generations.

	Large muscovite porphyroclasts						Younger deformation fabric		Older deformation fabric				
Na_2O	0.69	0.70	0.08	0.71	0.67	0.60	0.68	0.71	0.08	0.14	0.06	0.05	0.05
MgO	0.66	0.53	2.09	0.57	0.54	0.50	0.46	0.48	1.94	1.83	1.85	1.91	1.94
Al_2O_3	35.50	35.60	23.40	35.30	35.20	35.30	35.60	35.20	25.10	25.80	26.00	25.30	25.10
SiO_2	46.10	45.30	48.60	45.60	44.80	45.60	45.10	44.60	49.10	49.10	49.40	49.50	49.70
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	10.90	10.80	9.49	10.30	10.60	11.10	10.30	10.10	11.30	11.00	8.71	10.95	11.00
TiO_2	0.0065	0.0008	0.0485	0.00	0.0057	0.0089	0.00	0.00	0.015	0.00	0.013	0.005	0.00
BaO	0.00	0.08	0.12	0.08	0.25	0.35	0.48	0.55	0.10	0.12	0.13	0.13	0.12
MnO	0.00	0.00	0.02	0.02	0.03	0.03	0.02	0.04	0.02	0.08	0.05	0.05	0.08
FeO	1.11	1.06	5.73	1.22	1.01	1.11	1.10	1.19	6.37	5.97	6.09	6.05	6.21
Total	94.90	94.20	89.60	93.80	93.10	94.70	93.70	92.80	94.00	94.10	92.30	93.90	94.20

b. Analysis on other mineral structures.

	Large garnet porphyroblast			Φ-type pressure shadow albite		Quartz	
Na_2O	0.03	0.07	0.00	11.50	11.70	0.00	0.02
MgO	0.61	0.20	0.43	0.00	0.00	0.02	0.00
Al_2O_3	20.60	20.50	20.70	19.40	19.70	0.00	0.00
SiO_2	36.40	37.60	37.50	68.70	69.00	100.00	100.00
CaO	9.25	19.00	15.70	0.04	0.13	0.01	0.00
K_2O	0.12	0.01	0.01	0.15	0.10	0.00	0.00
TiO_2	0.0117	0.0446	0.0243	0.0031	0.00	0.00	0.00
BaO	0.02	0.00	0.11	0.11	0.39	0.18	0.06
MnO	6.57	3.79	4.48	0.00	0.01	0.03	0.02
FeO	25.30	17.70	20.50	0.04	0.06	0.04	0.04
Total	98.80	98.90	99.40	100.00	101.00	101.00	100.60

(V) EPMA analysis on Garnet-mica schist (IO17-03) with two garnet growth generations

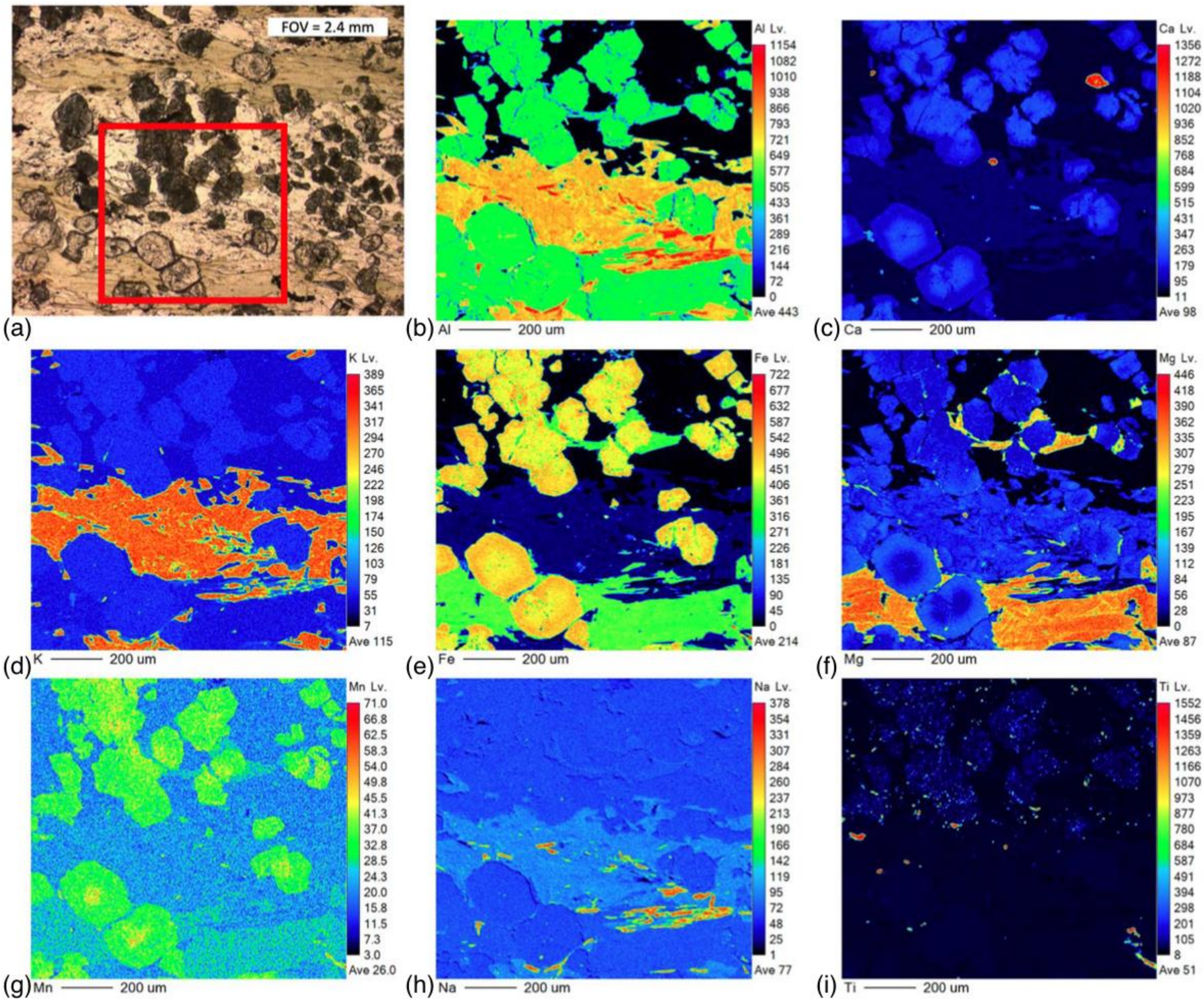
a. Analysis result on relics of early white mica fabric in sample IO17-03 from the garnet-mica schist tectonic slice.

	Relics of early deformation fabric in the groundmass	
Na_2O	0.62	0.88
MgO	2.79	2.61
Al_2O_3	28.50	29.30
SiO_2	49.80	49.00
CaO	0.00	0.00
K_2O	10.20	10.00
TiO_2	0.011	0.020
BaO	0.26	0.24
MnO	0.03	0.04
FeO	2.34	1.92
Total	94.60	94.00

b. Analysis result on the garnet porphyroclast with a zoned structure.

	Dark rim		Light core	
Na_2O	0.00	0.04	0.05	0.06
MgO	2.71	2.97	3.12	2.59
Al_2O_3	20.50	20.80	20.40	20.50
SiO_2	37.30	37.20	36.60	36.60
CaO	4.83	5.15	1.40	1.67
K_2O	0.01	0.01	0.00	0.00
TiO_2	0.15	0.20	0.059	0.02
BaO	0.55	0.49	4.16	3.83
MnO	33.30	33.00	33.30	33.80
FeO	0.00	0.03	0.05	0.06
Total	99.40	99.80	99.10	99.30

c. Elemental map identifying chemical differences among the two garnet generations. (a) Thin-section photo under XPL (b-i not labelled) elemental content across the scanned area. Image (i) displays concentrated Titanium, this signals the location of rutile crystal within the fabric.



(VI) EPMA analysis on Garnet-mica schist (IO18-05) with rutile inclusion within garnet porphyroblasts

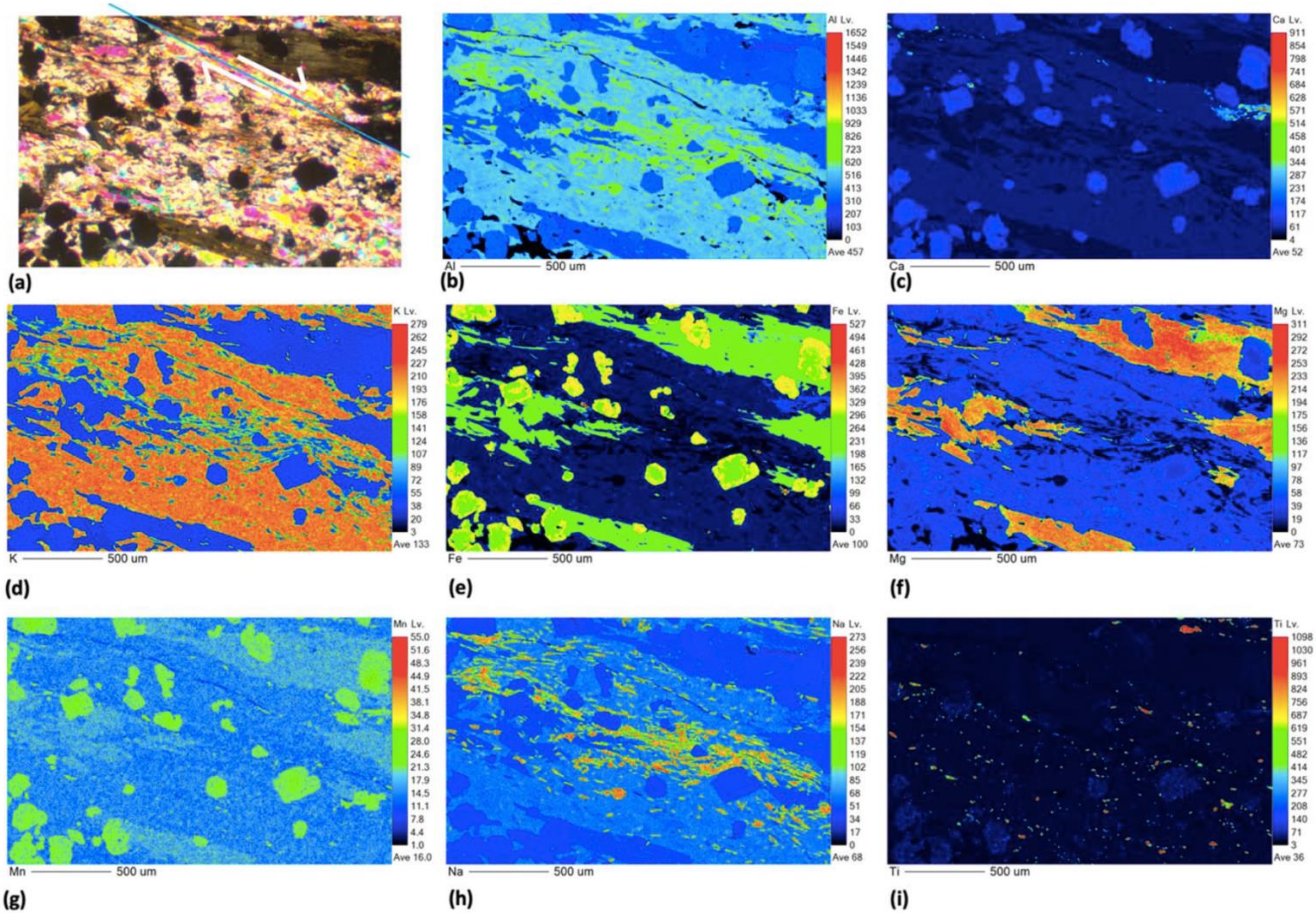
a. Analysis result on relics of two generations of white mica in sample IO18-05 collected from the hinge area of an isoclinal fold from the garnet-mica schist tectonic slice

	Younger deformation fabrics						**Relics of earlier deformation fabrics in low strain zone**		
Na_2O	0.79	0.78	7.13	0.67	0.69	0.69	0.86	0.66	0.54
MgO	2.32	2.13	0.15	2.39	2.69	2.52	2.43	2.74	2.82
Al_2O_3	29.30	29.40	38.60	28.90	28.00	28.20	29.20	27.70	28.20
SiO_2	48.50	48.50	47.10	48.70	49.50	49.00	49.00	49.40	49.90
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	10.00	10.10	0.85	9.93	9.90	10.10	10.10	10.30	10.10
TiO_2	0.00	0.011	0.00	0.00	0.00	0.015	0.0024	0.00	0.0041
BaO	0.29	0.31	0.03	0.39	0.24	0.23	0.21	0.28	0.24
MnO	0.00	0.02	0.00	0.00	0.00	0.02	0.03	0.02	0.02
FeO	3.07	3.12	0.40	3.18	2.81	2.84	3.19	2.63	2.96
Total	94.30	94.40	94.20	94.20	93.80	93.60	95.10	93.70	94.80

b. Analysis result on the second-stage garnet porphyroblast growth within quartz foam texture

	Garnet within quartz foam texture			
Na_2O	0.09	0.13	0.00	0.05
MgO	1.99	2.03	1.79	0.08
Al_2O_3	20.40	20.60	20.70	38.90
SiO_2	37.00	36.90	36.70	46.90
CaO	2.43	2.50	2.90	0.04
K_2O	0.00	0.01	0.01	0.11
TiO_2	0.026	0.021	0.045	0.0068
BaO	0.00	0.09	0.00	0.29
MnO	0.98	0.98	0.93	0.07
FeO	36.80	36.50	36.60	0.73
Total	99.70	99.70	99.60	87.20

c. Elemental map identifying chemical differences in the relics of early deformation fabric in low strain zone shielded by garnet porphyroclasts. A micro-normal fault is observed on the edge of this low strain zone. (a) Thin-section under XPL, (b-i) elemental content across the scanned area. Image (i) displays concentrated Titanium, signalling rutile crystals within the fabric.



Supplementary materials - Methods and procedures for $^{40}Ar/^{39}Ar$ analysis.

Mineral separation

Mineral separation for argon geochronology is based on microstructure analysis on rock samples. Once the target microstructure is identified, rock specimens were dissected to separate specific microstructures for direct dating, with special care to collect only fresh grains for analysis. When white mica deformation fabrics are intergrown and unable to be separated (e.g. multiple generations of mineral growth produced crystals with similar grain size), more than one generation of white mica will be included in the analysis. Any weathered edges of rock sections were removed, and fresh rock sections were then reduced to 1 cm thick pieces or less by the anvil-top manual rock splitter. The pieces were milled to < 420 μm grains by the ring mill. Grains are then sieved into four size fractions: 355-420 μm; 250-355 μm; 150-250 μm and < 150 μm. Grains are checked under the microscope to ensure selection of 'intact' grains. Mineral grains with 355-420 μm diameter were selected for analysis in this study, this ensures the intact mineral grains are collected from a specific fabric as the older fabrics are observed as relics concentrated in 'pockets' in low strain zone. Mineral grains were then subjected to magnetic separation using the FRANZ. This procedure separates the biotite-rich fraction, the targeted white mica-rich fraction and the non-magnetic fraction. All separates are archived in the team's collection, the white mica-enriched fraction is hand-picked under microscope in the microscope room of the Structural and Tectonics group, ANU. Hand picking aims to isolate a pure (~ 99%) fraction of single mineral type for analysis, white mica grains with slight weathering and iron staining from inclusion minerals are removed until visually pristine grains are achieved.

Sample irradiation details

Irradiation of samples for $^{40}Ar/^{39}Ar$ analysis is required, this was undertaken at the University of California Davis McClellan Nuclear Research Centre, CA, US. The new samples presented in this paper were done in two irradiation batches, numbered ANU CAN #31and ANU CAN #32 respectively. Irradiation power for CAN #31 and #32 were 20.02 MWh (~ 24 hours) in October 2018 and 8.03 MWh in December 2018 (~ 8 hours) respectively. The irradiation cannister had 1.0 mm cadmium shielding (Tetley et al. 1980). For each sample, calculated amounts of grains were weighed, recorded and wrapped in labelled aluminium packets in preparation for irradiation. The sample filled foils were placed into a quartz irradiation cannister together with aliquots of the flux monitor GA1550. The GA1550 standards are dispersed throughout the irradiated cannister, between the unknown age samples. In addition, packets containing K_2SO_4, CaF_2 and KCl were placed in the middle of the canister to monitor ^{40}Ar production from potassium. Irradiated samples were unwrapped upon their return to the Australian National University, and then rewrapped in tin foil in preparation for analysis in the mass spectrometer, the tin foil is melted in the furnace and gases pumped away prior to the sample analysis.

<u>$^{40}Ar/^{39}Ar$ procedures and analysis information</u>

Samples and standards were analysed in the Argon Laboratory at the Research School of Earth Science, The Australian National University, Canberra, Australia using a *Thermo Fisher* ARGUS-VI multi-collector mass spectrometer. A furnace step-heating technique was used to extract argon isotopes from the samples to ensure 100% release of ^{39}Ar and the furnace was degassed 4 times at 1,450°C for 15 minutes and the gas pumped away prior to the loading of the subsequent samples, while the flux monitors crystals (GA1550 biotite) were fused using a CO_2 continuous-wave laser.

Gas released from either the flux monitors or each step of the sample's analyses, was exposed to three different Zr-Al getters for 10 minutes to remove active gases and the purified extracted gasses were isotopically analysed in the Argus VI mass spectrometer. Samples were analysed within 30 steps with temperatures of the overall schedule rising from 450° to 1,450°C. The $^{40}Ar/^{39}Ar$ dating technique is adapted from McDougall & Harrison (1999) and described in Forster & Lister (2009).

The background levels were measured and subtracted from all analysis, laser and furnace. The nuclear interfering values for the correction factors for the isotopes are listed below. These are measured for the reactions and uncertainties of $(^{36}Ar/^{37}Ar)Ca$, $(^{39}Ar/^{37}Ar)Ca$, $(^{40}Ar/^{39}Ar)K$, $(^{38}Ar/^{39}Ar)K$ and $(^{38}Ar)Cl/(^{39}Ar)K$, and were calculated prior to sample analysis.

^{40}K abundances and decay constants are calculated by the Steiger & Jager (1977) method. Stated precisions for $^{40}Ar/^{39}Ar$ ages include all uncertainties in the measurement of isotope ratios and are quoted at the one sigma level and exclude errors in the age of the fluence monitor GA1550 (98.5 ±0.8 Ma). The reported data have been corrected for system backgrounds, mass discrimination, fluence gradients and atmospheric contamination. GA1550 standards were analysed, and a linear best fit was then used for the calculation of the J-factor and J-factor uncertainty.

Data reductions were done with an adapted version of Noble Software (2020, written and adapted by the Australian National University Argon Laboratory). The data reduction was based on optimising MSWD (the mean square of weighted deviates) of isotope intensities with an exponential best fit methodology. The discrimination factor was calculated by analysing five Air Shots analysis on either side of sample analysis, based on the atmospheric $^{40}Ar/^{36}Ar$ ratio (298.57; see Lee et al., 2006), and the calculation of the 1amu was used for the discrimination factor.

Tables A1-A2, which includes details on: the heating schedule, Argon isotope abundances and uncertainty levels, %Ar*, $^{40}Ar^{*}/^{39}Ar(K)$, Cumulative $^{39}Ar\%$, Age and uncertainty, Ca/K, Cl/K, J-factor and J-factor uncertainty, noting that the fractional uncertainties are shown as %, and are stated in the headings of the appropriate columns. Uncertainty levels of the calculated ages are at one sigma.

Flux Monitor: GA 1550 with reported age = 98.5±0.8 Ma (Spell & McDougall, 2003)

Lambda ^{40}K: 5.5430E-10

Table A1 - Irradiation details for all three cannisters used in the study

Correction Factors	CAN #31	CAN #32
$(^{36}Ar/^{37}Ar)Ca$	2.24512E-04	1.238E-04
$(^{39}Ar/^{37}Ar)Ca$	7.65305E-04	9.431E-04
$(^{40}Ar/^{39}Ar)K$	6.60898E-03	2.809E-02
$(^{38}Ar/^{39}Ar)K$	1.15553E-02	1.136E-02
$(^{38}Ar)Cl/(^{39}Ar)K$	8.15099E-02	8.026E-02
Ca/K conversion	1.90	1.90
Discrimination factor	1.00623 ± 0.20%	1.00568 ± 0.18%
Irradiation date (duration)	October 2018 (~24 hr)	December 2018 (8 hr)

Table A2 - Sample details

CAN	Sample	Foil	J-Factor	J-Factor uncertainty	Mineral	Measurement Date
#31	IO17-05	H2	3.95817E-03	0.4782	White Mica	15 Jan 2019
	IO17-04	H3	3.96051E-03	0.4781	White Mica	17 Jan 2019
	IO17-03	H4	3.96286E-03	0.4779	White Mica	21 Feb 2019
#32	IO18-01	H5	1.57300E-03	0.2506	White Mica	02 Jun 2019
	IO18-01	H9	1.57417E-03	0.2505	K-feldspar	10 Jun 2019
	IO18-05	H7	1.57359E-03	0.2505	White Mica	22 Apr 2019

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Supplementary materials - $^{40}Ar/^{39}Ar$ geochronology data files

Experimental data of sample AG03-03, AG03-04 and AG03-05 are presented in Forster and Lister, 2009. These three samples are considered 're-used' material for analyses in this study, those data files are therefore excluded from this supplementary material.

Sample: IO17-05 (H2), Mineral: White Mica

Temp (C)	Ar36 (mol)	err (%)	Ar37 (mol)	err (%)	Ar38 (mol)	err (%)	Ar39 (mol)	err (%)	Ar40 (mol)	err (%)	% Ar40*	Ar40*/ Ar39(K)	Cumulative Ar39(%)	Calculated Age Ma	±	1 s.d.	Ca/K	Cl/K
450	1.72E-16	2.10	1.45E-17	50.01	4.59E-17	4.92	8.00E-16	0.51	5.29E-14	0.51	2.82	1.87	0.02	13.27	±	9.87	3.44E-02	8.52E-02
480	2.90E-16	1.53	1.45E-17	50.01	7.93E-17	4.13	2.07E-15	0.42	9.28E-14	0.42	6.56	2.94	0.08	20.84	±	4.70	1.33E-02	1.75E-02
510	2.91E-16	1.53	1.45E-17	50.01	9.77E-17	3.35	3.56E-15	0.40	1.05E-13	0.40	17.26	5.10	0.17	36.02	±	2.75	7.75E-03	1.40E-02
540	2.86E-16	1.61	1.15E-16	27.90	9.37E-17	3.21	3.49E-15	0.40	1.05E-13	0.40	18.34	5.50	0.26	38.88	±	2.89	6.28E-02	5.80E-03
570	2.95E-16	1.56	1.45E-17	50.01	9.70E-17	2.84	3.81E-15	0.40	1.09E-13	0.40	19.59	5.63	0.36	39.76	±	2.65	7.25E-03	4.55E-04
600	3.25E-16	1.44	2.91E-16	7.78	1.46E-16	1.74	7.69E-15	0.40	1.51E-13	0.40	35.79	7.04	0.57	49.58	±	1.40	7.19E-02	2.26E-03
630	4.01E-16	1.39	4.74E-16	3.89	2.27E-16	1.33	1.30E-14	0.39	2.16E-13	0.40	44.57	7.44	0.91	52.37	±	1.03	6.95E-02	4.87E-03
660	3.58E-16	1.45	6.66E-16	3.21	2.91E-16	1.14	1.93E-14	0.39	2.63E-13	0.39	59.20	8.05	1.42	56.55	±	0.72	6.55E-02	2.04E-03
690	3.84E-16	1.45	1.00E-15	2.54	4.34E-16	0.87	3.10E-14	0.39	3.68E-13	0.39	68.81	8.16	2.24	57.36	±	0.56	6.13E-02	2.24E-03
720	4.20E-16	1.37	1.29E-15	2.05	6.41E-16	0.64	4.84E-14	0.40	5.32E-13	0.40	76.36	8.38	3.53	58.86	±	0.48	5.07E-02	1.40E-03
750	4.27E-16	1.36	1.62E-15	1.47	8.70E-16	0.58	6.88E-14	0.43	7.09E-13	0.43	81.98	8.45	5.35	59.33	±	0.45	4.47E-02	5.02E-04
780	4.43E-16	1.33	1.93E-15	1.18	1.25E-15	0.54	1.03E-13	0.43	1.08E-12	0.43	87.66	9.13	8.09	64.04	±	0.45	3.55E-02	3.16E-03
810	5.30E-16	1.34	1.94E-15	1.31	2.10E-15	0.48	1.79E-13	0.42	1.90E-12	0.42	91.63	9.72	12.84	68.13	±	0.45	2.05E-02	4.71E-03
840	7.54E-16	1.25	1.70E-15	1.62	4.22E-15	0.47	3.63E-13	0.43	3.82E-12	0.43	94.06	9.92	22.45	69.51	±	0.45	8.89E-03	3.72E-03
870	9.63E-16	1.27	1.50E-15	1.43	7.11E-15	0.46	6.16E-13	0.42	6.86E-12	0.43	95.75	10.66	38.76	74.53	±	0.48	4.62E-03	3.61E-03
900	9.45E-16	1.23	1.54E-15	1.57	7.13E-15	0.45	6.18E-13	0.42	7.44E-12	0.42	96.15	11.57	55.13	80.80	±	0.51	4.74E-03	3.64E-03
930	8.74E-16	1.25	1.87E-15	1.25	5.53E-15	0.48	4.77E-13	0.43	5.83E-12	0.43	95.47	11.66	67.77	81.38	±	0.53	7.44E-03	3.65E-03
960	8.68E-16	1.31	1.39E-15	1.74	4.82E-15	0.54	4.08E-13	0.44	4.51E-12	0.44	94.20	10.41	78.57	72.86	±	0.48	6.45E-03	1.46E-03
990	8.74E-16	1.23	5.79E-16	3.41	5.00E-15	0.40	4.12E-13	0.39	3.97E-12	0.39	93.36	8.99	89.49	63.09	±	0.40	2.67E-03	2.29E-03
1020	6.36E-16	1.25	3.29E-16	6.62	2.59E-15	0.41	2.10E-13	0.39	1.92E-12	0.39	90.05	8.24	95.05	57.90	±	0.38	2.98E-03	2.54E-03
1050	5.20E-16	1.30	2.81E-16	9.58	8.42E-16	0.52	6.37E-14	0.39	7.63E-13	0.39	79.59	9.54	96.74	66.88	±	0.50	8.38E-03	2.28E-03
1080	5.01E-16	1.31	2.59E-16	8.41	4.31E-16	0.69	2.90E-14	0.39	5.35E-13	0.39	72.01	13.28	97.51	92.43	±	0.80	1.69E-02	2.20E-03
1110	5.50E-16	1.32	2.38E-16	10.47	3.78E-16	0.82	2.37E-14	0.39	5.41E-13	0.39	69.63	15.91	98.14	110.14	±	1.00	1.91E-02	2.30E-03
1140	5.70E-16	1.30	3.10E-16	9.77	3.12E-16	0.88	1.78E-14	0.39	4.43E-13	0.39	61.53	15.31	98.61	106.16	±	1.17	3.31E-02	2.00E-03
1170	6.02E-16	1.25	5.18E-16	4.10	2.47E-16	1.09	1.21E-14	0.39	3.13E-13	0.39	42.65	11.01	98.93	76.98	±	1.49	8.12E-02	2.26E-03
1200	5.04E-16	1.31	7.66E-16	2.74	1.92E-16	1.47	8.43E-15	0.40	2.37E-13	0.40	36.55	10.28	99.15	71.92	±	1.80	1.73E-01	5.13E-03
1250	6.75E-16	1.26	1.20E-15	1.82	2.26E-16	1.42	8.86E-15	0.40	2.79E-13	0.40	27.72	8.72	99.39	61.24	±	2.17	2.58E-01	2.68E-03
1300	9.37E-16	1.22	5.30E-16	3.37	2.62E-16	1.16	8.37E-15	0.40	3.35E-13	0.40	16.38	6.55	99.61	46.15	±	3.06	1.20E-01	5.84E-03
1350	1.10E-15	1.22	1.16E-16	23.40	2.63E-16	1.01	5.50E-15	0.40	3.48E-13	0.40	5.56	3.52	99.75	24.97	±	5.44	3.99E-02	1.65E-03
1450	3.98E-15	1.18	1.08E-16	26.87	7.99E-16	0.52	9.28E-15	0.40	1.10E-12	0.40	0.01	0.00	100.00	0.01	±	11.33	2.22E-02	3.60E-02

Lambda K40=5.5430E-10 *J= 3.9582E-3 ± %0.48*

Sample: IO17-04 (H3), Mineral: White Mica

Temp	Ar36	err	Ar37	err	Ar38	err	Ar39	err	Ar40	err	% Ar40*	Ar40*/	Cumulative	Calculated Age			Ca/K	Cl/K
(C)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)		Ar39(K)	Ar39(%)	Ma	±	1 s.d.		
450	1.46E-16	2.43	1.51E-17	50.01	3.81E-17	6.51	4.72E-16	0.57	5.28E-14	0.57	17.31	19.37	0.01	133.38	±	15.53	6.08E-02	1.64E-01
480	2.50E-16	1.68	1.51E-17	50.01	6.00E-17	4.54	1.45E-15	0.44	9.83E-14	0.44	23.95	16.29	0.05	112.79	±	6.20	1.99E-02	1.56E-02
510	2.78E-16	1.56	1.51E-17	50.01	9.15E-17	3.21	3.15E-15	0.40	1.45E-13	0.40	42.77	19.68	0.13	135.38	±	3.05	9.11E-03	1.89E-02
540	3.00E-16	1.62	1.51E-17	50.01	1.16E-16	2.91	4.60E-15	0.40	1.51E-13	0.40	40.45	13.26	0.25	92.35	±	2.37	6.26E-03	2.33E-02
570	3.16E-16	1.49	2.09E-16	19.40	1.49E-16	1.90	7.16E-15	0.41	1.99E-13	0.41	52.61	14.63	0.43	101.63	±	1.60	5.55E-02	1.58E-02
600	3.29E-16	1.38	3.23E-16	8.25	2.05E-16	1.52	1.23E-14	0.43	3.18E-13	0.43	69.11	17.86	0.75	123.33	±	1.19	5.00E-02	3.97E-03
630	3.00E-16	1.56	2.44E-16	10.30	2.46E-16	1.26	1.69E-14	0.43	3.98E-13	0.44	77.45	18.20	1.19	125.54	±	1.05	2.74E-02	2.81E-03
660	2.90E-16	1.53	2.94E-16	7.88	3.15E-16	1.06	2.30E-14	0.41	5.22E-13	0.41	83.38	18.94	1.78	130.50	±	0.95	2.44E-02	1.70E-03
690	3.05E-16	1.61	3.22E-16	5.72	4.12E-16	0.80	3.15E-14	0.40	6.98E-13	0.41	86.92	19.27	2.59	132.68	±	0.91	1.94E-02	2.66E-03
720	3.28E-16	1.53	4.11E-16	5.52	5.37E-16	0.64	4.23E-14	0.40	9.43E-13	0.41	89.59	19.97	3.68	137.33	±	0.90	1.85E-02	3.18E-03
750	3.46E-16	1.44	4.84E-16	5.23	6.92E-16	0.62	5.62E-14	0.40	1.27E-12	0.40	91.85	20.79	5.13	142.72	±	0.91	1.64E-02	4.36E-03
780	4.36E-16	1.44	6.16E-16	3.70	1.05E-15	0.54	8.59E-14	0.43	2.10E-12	0.44	93.78	22.91	7.34	156.69	±	1.02	1.36E-02	3.38E-03
810	9.39E-16	1.28	9.03E-16	2.35	2.88E-15	0.52	2.34E-13	0.44	5.89E-12	0.44	95.22	23.95	13.37	163.49	±	1.04	7.32E-03	2.30E-04
840	1.03E-15	1.23	1.01E-15	2.06	4.60E-15	0.40	3.71E-13	0.39	9.23E-12	0.39	96.66	24.07	22.92	164.26	±	0.99	5.19E-03	4.33E-03
870	1.20E-15	1.20	1.91E-15	1.26	7.51E-15	0.40	6.10E-13	0.39	1.49E-11	0.39	97.58	23.89	38.63	163.10	±	0.98	5.95E-03	4.95E-03
900	1.41E-15	1.19	5.04E-15	0.89	8.39E-15	0.40	6.73E-13	0.39	1.65E-11	0.39	97.43	23.87	55.97	162.94	±	0.98	1.42E-02	6.44E-03
930	8.26E-16	1.22	4.86E-15	1.00	3.75E-15	0.40	2.97E-13	0.39	7.87E-12	0.39	96.84	25.63	63.63	174.42	±	1.05	3.10E-02	6.96E-03
960	6.76E-16	1.24	4.86E-15	0.93	3.02E-15	0.41	2.40E-13	0.39	6.36E-12	0.39	96.81	25.64	69.82	174.46	±	1.05	3.84E-02	6.10E-03
990	5.28E-16	1.27	4.45E-15	0.92	2.37E-15	0.42	1.90E-13	0.39	5.00E-12	0.39	96.83	25.46	74.73	173.29	±	1.04	4.45E-02	4.77E-03
1020	4.48E-16	1.36	8.60E-15	0.83	1.94E-15	0.43	1.57E-13	0.39	4.12E-12	0.39	96.75	25.46	78.77	173.32	±	1.04	1.04E-01	3.96E-03
1050	4.61E-16	1.35	1.23E-14	0.82	2.12E-15	0.42	1.72E-13	0.39	4.52E-12	0.39	96.95	25.49	83.19	173.48	±	1.04	1.36E-01	3.67E-03
1080	4.97E-16	1.31	9.17E-15	0.82	2.80E-15	0.41	2.29E-13	0.39	5.86E-12	0.39	97.45	24.96	89.09	170.08	±	1.02	7.61E-02	3.61E-03
1110	5.13E-16	1.25	7.19E-15	0.85	2.70E-15	0.41	2.21E-13	0.39	5.61E-12	0.39	97.26	24.68	94.79	168.23	±	1.01	6.17E-02	3.03E-03
1140	5.03E-16	1.29	7.67E-15	0.86	1.39E-15	0.50	1.10E-13	0.39	2.86E-12	0.39	94.74	24.52	97.64	167.21	±	1.02	1.32E-01	2.86E-03
1170	5.39E-16	1.35	7.67E-15	0.84	5.20E-16	0.68	3.61E-14	0.39	1.04E-12	0.39	84.52	24.33	98.57	165.94	±	1.13	4.04E-01	2.21E-03
1200	4.56E-16	1.35	5.86E-15	0.85	2.92E-16	0.96	1.77E-14	0.39	5.57E-13	0.39	75.60	23.86	99.02	162.89	±	1.30	6.31E-01	4.28E-03
1250	4.92E-16	1.36	5.19E-15	0.90	2.48E-16	1.15	1.33E-14	0.39	4.48E-13	0.39	67.22	22.61	99.36	154.74	±	1.49	7.42E-01	5.27E-03
1300	5.20E-16	1.30	1.02E-14	0.84	1.88E-16	1.64	7.46E-15	0.40	3.31E-13	0.40	53.31	23.69	99.56	161.78	±	2.23	2.60E+00	1.39E-02
1350	6.84E-16	1.25	7.24E-15	0.86	2.08E-16	1.45	6.48E-15	0.40	3.59E-13	0.40	43.22	23.98	99.72	163.67	±	3.04	2.12E+00	1.83E-02
1450	8.02E-16	1.23	1.41E-15	1.77	2.74E-16	1.19	1.07E-14	0.39	5.60E-13	0.39	57.29	29.88	100.00	201.78	±	2.38	2.50E-01	5.72E-03

Lambda K40=5.5430E-10 *J= 3.9605E-3 ± %0.48*

Sample: IO17-03 (H4), Mineral: White Mica

Temp (C)	Ar36 (mol)	err (%)	Ar37 (mol)	err (%)	Ar38 (mol)	err (%)	Ar39 (mol)	err (%)	Ar40 (mol)	err (%)	% Ar40*	Ar40*/ Ar39(K)	Cumulative Ar39(%)	Calculated Age Ma	±	1 s.d.	Ca/K	Cl/K
450	1.15E-16	2.36	2.84E-17	50.01	2.89E-17	14.48	3.21E-16	0.72	3.83E-14	0.72	10.37	12.37	0.01	86.34	±	18.15	1.68E-01	1.22E-01
480	1.29E-16	1.82	2.84E-17	50.00	3.88E-17	7.18	1.09E-15	0.35	4.73E-14	0.35	18.39	8.02	0.06	56.42	±	4.61	4.97E-02	1.67E-02
510	1.32E-16	2.19	1.80E-16	14.18	7.20E-17	4.16	3.59E-15	0.21	6.61E-14	0.21	40.51	7.45	0.21	52.50	±	1.71	9.53E-02	1.81E-02
540	1.44E-16	1.58	3.49E-16	8.27	1.21E-16	2.60	7.17E-15	0.21	8.37E-14	0.21	48.70	5.68	0.50	40.17	±	0.71	9.24E-02	1.79E-02
570	1.48E-16	2.22	3.80E-16	8.79	1.79E-16	1.59	1.23E-14	0.20	1.06E-13	0.20	58.46	5.05	1.01	35.73	±	0.59	5.87E-02	8.20E-03
600	1.45E-16	1.86	5.11E-16	5.83	3.16E-16	0.71	2.40E-14	0.20	1.67E-13	0.20	73.91	5.13	1.99	36.32	±	0.31	4.04E-02	5.32E-03
630	1.44E-16	1.81	7.54E-16	5.16	4.33E-16	0.56	3.38E-14	0.20	2.14E-13	0.20	79.87	5.07	3.38	35.87	±	0.25	4.24E-02	5.65E-03
660	1.54E-16	2.12	9.83E-16	3.65	6.30E-16	0.46	4.93E-14	0.20	3.09E-13	0.20	85.05	5.33	5.41	37.73	±	0.24	3.79E-02	7.69E-03
690	1.62E-16	2.04	1.37E-15	2.48	8.50E-16	0.43	6.90E-14	0.20	4.54E-13	0.20	89.29	5.87	8.25	41.49	±	0.24	3.76E-02	3.71E-03
720	1.75E-16	1.69	1.70E-15	2.22	1.14E-15	0.29	9.64E-14	0.20	6.74E-13	0.20	92.17	6.44	12.21	45.48	±	0.24	3.36E-02	1.04E-03
750	1.87E-16	1.64	1.63E-15	1.50	1.38E-15	0.28	1.19E-13	0.20	8.69E-13	0.20	93.49	6.81	17.11	48.05	±	0.25	2.61E-02	3.90E-03
780	2.22E-16	1.31	1.38E-15	2.35	1.74E-15	0.27	1.50E-13	0.20	1.17E-12	0.20	94.25	7.31	23.30	51.54	±	0.27	1.74E-02	3.72E-03
810	2.79E-16	1.04	1.38E-15	2.22	2.83E-15	0.23	2.43E-13	0.20	2.14E-12	0.20	96.03	8.44	33.30	59.37	±	0.31	1.08E-02	1.99E-03
840	3.29E-16	1.01	1.30E-15	2.40	3.89E-15	0.21	3.33E-13	0.20	3.40E-12	0.20	97.05	9.90	47.01	69.39	±	0.36	7.39E-03	1.07E-03
870	3.67E-16	0.87	2.37E-15	1.32	4.21E-15	0.21	3.59E-13	0.20	4.08E-12	0.20	97.26	11.04	61.78	77.22	±	0.39	1.25E-02	5.38E-04
900	3.17E-16	0.89	2.44E-15	1.41	3.45E-15	0.22	2.94E-13	0.20	3.31E-12	0.20	97.08	10.93	73.86	76.47	±	0.39	1.58E-02	3.59E-04
930	2.72E-16	1.10	2.30E-15	1.42	2.63E-15	0.24	2.24E-13	0.20	2.41E-12	0.20	96.58	10.39	83.09	72.82	±	0.37	1.95E-02	8.84E-04
960	2.31E-16	1.32	1.73E-15	1.82	2.08E-15	0.26	1.77E-13	0.20	1.74E-12	0.20	95.97	9.41	90.38	66.05	±	0.34	1.86E-02	1.20E-03
990	1.96E-16	1.50	1.25E-15	2.13	1.27E-15	0.32	1.08E-13	0.20	1.00E-12	0.20	94.09	8.74	94.81	61.45	±	0.32	2.20E-02	1.57E-03
1020	1.68E-16	1.83	4.01E-15	1.06	5.61E-16	0.47	4.60E-14	0.20	4.62E-13	0.20	89.14	8.96	96.70	62.95	±	0.36	1.66E-01	5.85E-04
1050	1.73E-16	1.49	7.71E-15	0.71	3.23E-16	0.77	2.51E-14	0.20	2.95E-13	0.20	82.57	9.68	97.73	67.91	±	0.42	5.82E-01	2.29E-04
1080	1.70E-16	1.68	3.74E-15	0.98	2.17E-16	1.23	1.62E-14	0.20	2.26E-13	0.20	77.62	10.86	98.40	75.99	±	0.54	4.39E-01	2.05E-03
1110	1.71E-16	1.41	1.67E-15	2.26	1.56E-16	1.56	1.05E-14	0.20	1.70E-13	0.20	69.94	11.35	98.83	79.36	±	0.64	3.04E-01	2.79E-03
1140	1.88E-16	1.52	1.29E-15	2.76	1.34E-16	1.77	7.99E-15	0.20	1.45E-13	0.21	61.35	11.15	99.16	77.98	±	0.86	3.06E-01	9.34E-03
1170	2.07E-16	1.57	1.02E-15	3.70	1.20E-16	2.01	6.61E-15	0.21	1.38E-13	0.21	55.07	11.47	99.43	80.16	±	1.11	2.93E-01	8.00E-03
1200	2.27E-16	1.29	6.25E-16	5.02	1.01E-16	2.30	4.75E-15	0.21	1.24E-13	0.21	45.27	11.82	99.63	82.62	±	1.38	2.50E-01	7.73E-03
1250	3.03E-16	1.04	9.96E-16	4.31	9.46E-17	2.56	3.22E-15	0.22	1.31E-13	0.22	31.12	12.68	99.76	88.43	±	2.13	5.87E-01	1.97E-03
1300	4.11E-16	0.88	9.24E-16	3.24	1.10E-16	2.23	2.50E-15	0.23	1.53E-13	0.23	19.60	11.96	99.86	83.57	±	3.13	7.02E-01	1.08E-02
1350	5.30E-16	0.81	2.75E-16	11.11	1.37E-16	1.70	2.80E-15	0.23	1.94E-13	0.23	18.58	12.90	99.98	89.96	±	3.31	1.87E-01	1.63E-02
1450	9.91E-16	0.74	1.60E-16	17.43	1.97E-16	1.62	5.90E-16	0.41	3.15E-13	0.41	5.99	31.95	100.00	215.05	±	27.49	5.16E-01	2.18E-02

Lambda K40=5.5430E-10 *J= 3.9629E-3 ± %0.48*

Sample: IO18-01 (H5), Mineral: White Mica

Temp	Ar36	err	Ar37	err	Ar38	err	Ar39	err	Ar40	err	% Ar40*	Ar40*/	Cumulative	Calculated Age			Ca/K	Cl/K
(C)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)		Ar39(K)	Ar39(%)	Ma	±	1 s.d.		
450	3.88E-17	7.59	4.66E-17	50.03	7.10E-18	32.30	1.07E-16	1.58	1.96E-14	1.58	40.91	75.31	0.01	201.98	±	22.22	8.31E-01	1.71E-01
480	5.70E-17	4.50	4.67E-17	50.00	1.55E-17	25.72	4.20E-16	0.53	3.29E-14	0.53	48.19	37.75	0.03	104.06	±	5.02	2.11E-01	3.05E-03
510	7.50E-17	3.46	4.67E-17	50.00	2.66E-17	8.60	1.31E-15	0.28	6.03E-14	0.28	62.79	28.79	0.09	79.92	±	1.65	6.75E-02	2.41E-02
540	9.72E-17	2.69	4.67E-17	50.00	5.15E-17	5.68	2.70E-15	0.24	1.08E-13	0.24	73.12	29.26	0.23	81.19	±	0.85	3.28E-02	1.11E-02
570	1.03E-16	2.42	4.67E-17	50.00	7.29E-17	4.14	4.31E-15	0.23	1.59E-13	0.23	80.57	29.72	0.45	82.42	±	0.56	2.06E-02	1.27E-02
600	1.22E-16	2.38	4.68E-17	50.00	1.05E-16	3.02	6.94E-15	0.22	2.46E-13	0.22	85.14	30.20	0.81	83.72	±	0.45	1.28E-02	5.08E-03
630	1.34E-16	1.66	4.68E-17	50.00	1.52E-16	1.71	1.12E-14	0.22	3.76E-13	0.22	89.23	30.06	1.38	83.35	±	0.33	7.97E-03	1.45E-04
660	1.55E-16	1.48	4.68E-17	50.00	2.18E-16	1.19	1.64E-14	0.22	5.52E-13	0.22	91.52	30.84	2.22	85.46	±	0.31	5.43E-03	2.28E-03
690	2.18E-16	1.32	4.68E-17	50.00	3.00E-16	0.78	2.25E-14	0.22	8.09E-13	0.22	91.86	32.96	3.38	91.20	±	0.32	3.95E-03	1.69E-03
720	2.20E-16	1.14	4.69E-17	50.00	3.74E-16	0.77	2.90E-14	0.22	1.11E-12	0.22	93.98	35.83	4.86	98.92	±	0.34	3.07E-03	1.18E-03
750	3.14E-16	1.06	4.69E-17	50.00	5.70E-16	0.57	4.43E-14	0.22	2.10E-12	0.22	95.47	45.22	7.14	123.96	±	0.41	2.01E-03	1.87E-03
780	6.67E-16	0.75	4.69E-17	50.00	1.73E-15	0.27	1.39E-13	0.22	9.96E-12	0.22	97.96	70.25	14.26	189.09	±	0.60	6.42E-04	2.61E-03
810	6.60E-16	0.72	3.46E-16	8.48	3.57E-15	0.23	2.97E-13	0.21	2.09E-11	0.22	99.02	69.82	29.46	188.00	±	0.59	2.22E-03	3.12E-03
840	4.19E-16	0.85	4.08E-16	6.21	3.28E-15	0.24	2.76E-13	0.21	1.59E-11	0.22	99.16	56.98	43.62	154.85	±	0.49	2.81E-03	3.05E-03
870	3.49E-16	0.84	3.73E-16	8.68	2.48E-15	0.25	2.09E-13	0.21	1.05E-11	0.22	98.95	49.74	54.31	135.90	±	0.44	3.40E-03	2.86E-03
900	2.63E-16	1.10	3.67E-16	14.61	1.61E-15	0.28	1.35E-13	0.21	7.04E-12	0.22	98.83	51.73	61.21	141.14	±	0.45	5.18E-03	2.78E-03
930	1.99E-16	1.42	4.64E-16	12.10	1.07E-15	0.33	8.95E-14	0.22	5.31E-12	0.22	98.84	58.72	65.80	159.38	±	0.51	9.85E-03	2.28E-03
960	1.62E-16	1.51	3.75E-16	11.37	8.49E-16	0.37	7.10E-14	0.22	4.81E-12	0.22	98.95	66.96	69.44	180.68	±	0.57	1.00E-02	2.06E-03
990	1.40E-16	1.38	4.01E-16	17.99	7.72E-16	0.40	6.45E-14	0.22	4.66E-12	0.22	99.07	71.62	72.75	192.58	±	0.61	1.18E-02	2.48E-03
1020	1.33E-16	1.98	8.57E-16	5.84	8.04E-16	0.37	6.73E-14	0.22	4.83E-12	0.22	99.14	71.11	76.20	191.30	±	0.60	2.42E-02	2.70E-03
1050	1.38E-16	1.81	7.86E-16	6.28	1.01E-15	0.34	8.45E-14	0.22	5.82E-12	0.22	99.25	68.34	80.53	184.21	±	0.58	1.77E-02	2.95E-03
1080	1.45E-16	1.36	7.10E-16	6.85	1.37E-15	0.30	1.16E-13	0.22	8.18E-12	0.22	99.43	70.09	86.48	188.68	±	0.60	1.16E-02	2.37E-03
1110	1.27E-16	1.62	7.97E-16	7.18	1.51E-15	0.27	1.29E-13	0.22	9.71E-12	0.22	99.57	74.78	93.11	200.64	±	0.63	1.17E-02	2.13E-03
1140	7.87E-17	2.35	7.52E-16	6.90	9.62E-16	0.33	8.26E-14	0.22	6.47E-12	0.22	99.60	77.99	97.34	208.78	±	0.65	1.73E-02	1.38E-03
1170	5.22E-17	4.94	7.13E-16	11.30	3.27E-16	0.81	2.77E-14	0.22	2.21E-12	0.22	99.26	79.11	98.76	211.61	±	0.67	4.89E-02	9.10E-04
1200	5.23E-17	4.30	5.32E-16	24.30	1.34E-16	2.15	1.10E-14	0.22	8.83E-13	0.22	98.20	78.88	99.32	211.00	±	0.69	9.19E-02	1.29E-03
1250	5.39E-17	5.01	9.48E-16	9.08	7.74E-17	3.18	5.67E-15	0.22	4.56E-13	0.22	96.44	77.58	99.61	207.71	±	0.76	3.18E-01	6.20E-03
1300	5.14E-17	5.96	4.74E-17	50.00	4.23E-17	5.95	2.88E-15	0.23	2.41E-13	0.24	93.61	78.32	99.76	209.59	±	1.07	3.12E-02	7.72E-04
1350	5.48E-17	3.63	4.74E-17	50.00	3.33E-17	6.11	2.06E-15	0.26	1.74E-13	0.26	90.56	76.36	99.87	204.64	±	1.04	4.37E-02	3.30E-03
1450	1.03E-16	2.62	4.74E-17	50.00	5.42E-17	5.20	2.57E-15	0.23	2.50E-13	0.23	87.66	85.23	100.00	226.98	±	1.11	3.51E-02	2.67E-02

Lambda K40=5.5430E-10 *J= 1.5730E-3 ± %0.25*

Sample: IO18-01 (H9), Mineral: K-feldspar

Temp (C)	Ar36 (mol)	err (%)	Ar37 (mol)	err (%)	Ar38 (mol)	err (%)	Ar39 (mol)	err (%)	Ar40 (mol)	err (%)	% Ar40*	Ar40*/ Ar39(K)	Cumulative Ar39(%)	Calculated Age Ma	±	1 s.d.	Ca/K	Cl/K
450	4.81E-17	5.84	5.75E-17	50.04	7.99E-18	35.99	1.09E-16	1.84	1.10E-13	1.84	86.95	877.60	0.09	1565.42	±	24.06	1.00E+00	2.57E-01
450	5.11E-17	6.47	5.76E-17	50.01	7.75E-18	28.44	1.46E-16	1.14	2.90E-14	1.14	47.37	94.37	0.21	249.87	±	17.69	7.52E-01	2.96E-01
480	6.94E-17	3.72	5.76E-17	50.01	1.14E-17	18.93	2.27E-16	0.73	1.92E-13	0.73	89.22	757.10	0.40	1415.66	±	9.51	4.83E-01	2.27E-01
480	5.82E-17	4.99	5.76E-17	50.00	1.56E-17	22.36	3.92E-16	0.55	3.62E-14	0.55	51.96	47.99	0.72	131.37	±	6.00	2.79E-01	7.37E-03
510	5.63E-17	4.75	5.77E-17	50.00	1.83E-17	16.82	4.83E-16	0.47	1.57E-13	0.47	89.26	289.80	1.13	677.93	±	4.63	2.27E-01	5.87E-02
510	5.56E-17	5.32	5.77E-17	50.00	1.38E-17	17.61	8.31E-16	0.35	3.71E-14	0.35	55.24	24.67	1.82	68.74	±	2.94	1.32E-01	9.03E-02
540	4.74E-17	7.08	5.78E-17	50.00	1.59E-17	18.85	8.01E-16	0.34	7.42E-14	0.34	80.90	74.91	2.48	201.11	±	3.31	1.37E-01	3.19E-02
540	5.42E-17	5.32	5.78E-17	50.00	2.47E-17	11.78	1.48E-15	0.27	3.88E-14	0.27	58.21	15.29	3.71	42.92	±	1.63	7.43E-02	1.90E-02
570	6.63E-17	3.92	5.79E-17	50.00	2.85E-17	7.97	1.37E-15	0.32	1.35E-13	0.32	85.31	84.31	4.84	224.82	±	1.71	8.04E-02	5.49E-03
570	5.40E-17	6.04	5.79E-17	50.00	4.05E-17	8.48	2.32E-15	0.24	4.20E-14	0.24	61.51	11.14	6.77	31.36	±	1.18	4.74E-02	2.18E-02
600	7.78E-17	3.60	5.79E-17	50.00	3.81E-17	7.16	2.02E-15	0.25	1.48E-13	0.26	84.29	62.02	8.44	168.05	±	1.25	5.46E-02	3.70E-03
600	4.89E-17	4.66	5.80E-17	50.00	4.19E-17	5.63	3.06E-15	0.24	4.05E-14	0.24	63.77	8.45	10.98	23.84	±	0.63	3.60E-02	8.18E-03
650	5.79E-17	4.62	5.80E-17	50.00	6.11E-17	4.70	4.12E-15	0.23	1.05E-13	0.23	83.43	21.28	14.40	59.43	±	0.58	2.68E-02	1.04E-02
650	5.34E-17	4.59	5.80E-17	50.00	7.86E-17	3.71	5.49E-15	0.23	5.48E-14	0.23	70.61	7.05	18.95	19.91	±	0.38	2.01E-02	1.42E-02
700	4.75E-17	5.65	5.81E-17	50.00	7.50E-17	3.52	5.59E-15	0.22	7.33E-14	0.23	80.42	10.54	23.59	29.68	±	0.42	1.97E-02	5.62E-03
700	5.06E-17	5.14	5.81E-17	50.00	9.01E-17	2.83	6.75E-15	0.22	6.40E-14	0.23	76.10	7.21	29.20	20.35	±	0.33	1.63E-02	7.19E-03
750	3.37E-17	6.60	5.82E-17	50.00	6.85E-17	3.56	5.47E-15	0.22	6.72E-14	0.23	84.79	10.41	33.74	29.33	±	0.36	2.02E-02	1.23E-04
750	5.29E-17	5.60	5.82E-17	50.00	8.40E-17	3.17	6.80E-15	0.22	7.52E-14	0.22	78.72	8.70	39.38	24.55	±	0.38	1.63E-02	5.84E-03
800	4.65E-17	6.40	5.82E-17	50.00	8.09E-17	3.19	6.44E-15	0.22	1.08E-13	0.23	86.92	14.52	44.73	40.77	±	0.41	1.72E-02	1.76E-03
800	5.97E-17	5.60	5.83E-17	50.00	1.17E-16	2.20	8.71E-15	0.22	1.31E-13	0.22	86.26	13.02	51.96	36.61	±	0.35	1.27E-02	9.56E-03
850	5.62E-17	4.96	5.83E-17	50.00	1.14E-16	2.11	8.69E-15	0.22	1.68E-13	0.22	89.85	17.33	59.17	48.57	±	0.31	1.27E-02	7.14E-03
850	6.86E-17	3.91	5.83E-17	50.00	1.10E-16	2.51	8.38E-15	0.22	1.42E-13	0.22	85.38	14.44	66.13	40.56	±	0.30	1.32E-02	3.35E-03
900	4.91E-17	5.91	5.84E-17	50.00	6.34E-17	5.11	4.79E-15	0.23	9.92E-14	0.23	85.09	17.62	70.11	49.35	±	0.53	2.32E-02	5.41E-04
900	6.13E-17	3.73	5.84E-17	50.00	5.84E-17	3.79	3.91E-15	0.23	7.26E-14	0.23	74.63	13.86	73.35	38.93	±	0.51	2.84E-02	7.90E-03
950	3.99E-17	6.46	5.85E-17	50.00	3.04E-17	9.04	2.49E-15	0.24	5.71E-14	0.24	79.00	18.10	75.42	50.69	±	0.88	4.46E-02	2.67E-02
950	7.18E-17	4.52	5.85E-17	50.00	4.84E-17	5.92	2.96E-15	0.23	7.17E-14	0.24	70.00	16.97	77.88	47.57	±	0.93	3.76E-02	5.77E-03
950	1.09E-16	2.55	5.86E-17	50.00	5.48E-17	5.27	3.50E-15	0.23	9.81E-14	0.23	66.87	18.74	80.78	52.46	±	0.69	3.18E-02	1.89E-02
1000	3.38E-17	9.13	5.86E-17	50.00	2.42E-17	11.11	1.82E-15	0.26	5.72E-14	0.26	82.25	25.89	82.29	72.07	±	1.41	6.13E-02	1.94E-02
1000	6.29E-17	4.26	3.85E-16	22.79	4.18E-17	7.13	2.52E-15	0.24	8.38E-14	0.24	77.52	25.79	84.38	71.81	±	0.91	2.90E-01	6.91E-03
1000	1.10E-16	2.86	4.59E-16	21.65	5.29E-17	4.74	2.66E-15	0.23	1.17E-13	0.24	71.77	31.47	86.59	87.24	±	1.02	3.28E-01	9.90E-03
1050	3.84E-17	6.43	5.88E-17	50.00	2.06E-17	10.79	1.26E-15	0.29	7.60E-14	0.29	84.86	51.08	87.64	139.53	±	1.64	8.84E-02	9.23E-03
1050	7.16E-17	3.99	5.88E-17	50.00	3.00E-17	9.32	1.78E-15	0.25	1.31E-13	0.25	83.58	61.13	89.12	165.74	±	1.38	6.26E-02	2.57E-02
1050	1.21E-16	1.72	6.30E-16	16.78	5.23E-17	5.91	2.06E-15	0.26	1.89E-13	0.26	80.88	74.14	90.83	199.15	±	1.08	5.80E-01	3.76E-02
1100	4.08E-17	6.33	5.89E-17	50.00	2.05E-17	16.72	1.12E-15	0.30	1.22E-13	0.30	90.02	98.45	91.76	259.95	±	1.97	1.00E-01	2.36E-03
1100	9.73E-17	2.92	6.19E-16	22.38	3.57E-17	6.46	1.76E-15	0.26	2.16E-13	0.26	86.52	106.00	93.22	278.43	±	1.54	6.68E-01	1.78E-02
1100	1.73E-16	1.67	4.81E-16	13.72	5.01E-17	4.70	1.75E-15	0.26	2.67E-13	0.26	80.66	122.70	94.68	318.51	±	1.67	5.22E-01	1.48E-02
1150	4.44E-17	6.14	5.91E-17	50.00	1.66E-17	18.85	6.78E-16	0.39	1.20E-13	0.39	88.98	158.10	95.24	401.02	±	3.29	1.66E-01	9.93E-03
1200	6.86E-17	4.22	5.91E-17	50.00	2.29E-17	12.75	9.32E-16	0.32	1.91E-13	0.32	89.25	182.40	96.01	455.39	±	2.69	1.21E-01	6.47E-03
1250	6.99E-17	4.00	5.92E-17	50.00	1.96E-17	12.44	5.31E-16	0.46	1.52E-13	0.46	86.24	246.60	96.45	591.73	±	4.37	2.12E-01	1.07E-02
1300	6.33E-17	4.18	5.92E-17	50.01	1.77E-17	13.98	2.05E-16	0.92	1.47E-13	0.92	87.18	628.10	96.62	1240.26	±	11.20	5.49E-01	2.13E-01
1350	8.58E-17	3.32	5.92E-17	50.00	5.48E-17	4.87	3.22E-15	0.23	2.36E-13	0.23	89.10	65.26	99.30	176.42	±	0.91	3.50E-02	8.52E-03
1450	1.66E-16	1.89	5.93E-17	50.00	4.16E-17	5.53	8.49E-16	0.34	5.59E-13	0.34	91.15	599.90	100.00	1199.56	±	4.22	1.33E-01	1.43E-02

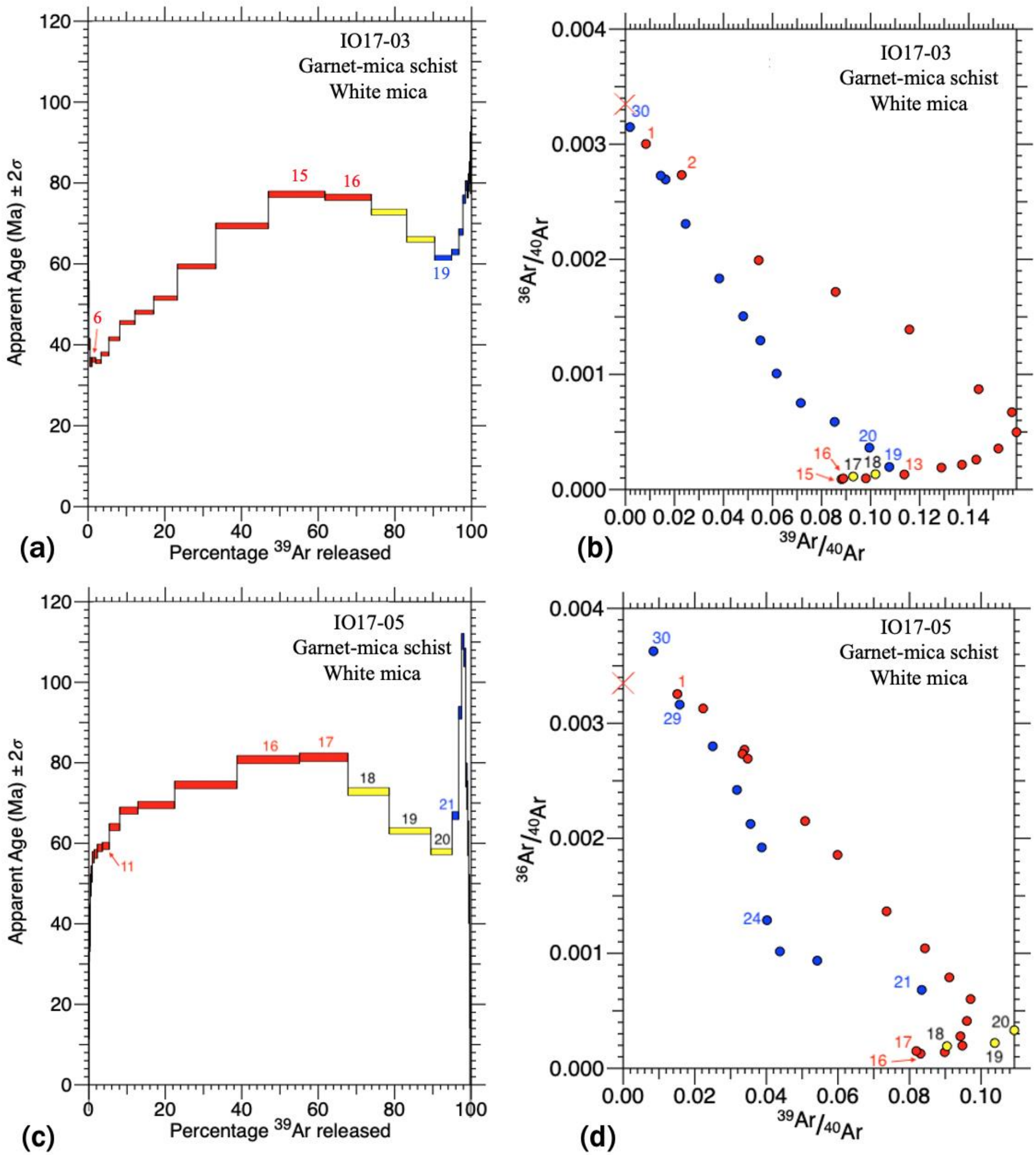
Lambda K40=5.5430E-10 *J= 1.5742E-3 ± %0.25*

Sample: IO18-05 (H7), Mineral: White Mica

Temp	Ar36	err	Ar37	err	Ar38	err	Ar39	err	Ar40	err	% Ar40*	Ar40*/	Cumulative	Calculated Age			Ca/K	Cl/K
(C)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)	(mol)	(%)		Ar39(K)	Ar39(%)	Ma	±	1 s.d.		
450	6.78E-18	42.70	2.07E-17	50.19	4.69E-18	30.96	3.35E-17	4.30	2.67E-15	4.31	24.18	19.27	0.13	53.89	±	71.69	1.18E+00	1.13E+00
480	6.89E-18	37.75	2.08E-17	50.05	5.35E-18	93.82	6.73E-17	2.24	3.32E-15	2.24	38.03	18.79	0.41	52.56	±	31.99	5.86E-01	6.07E-01
510	2.96E-18	32.27	2.08E-17	50.04	2.17E-18	71.38	1.09E-16	2.02	4.08E-15	2.03	78.31	29.40	0.84	81.58	±	7.41	3.63E-01	4.32E-02
540	6.00E-18	37.54	2.08E-17	50.01	2.61E-18	51.76	1.81E-16	1.11	5.33E-15	1.12	66.32	19.50	1.57	54.54	±	10.26	2.18E-01	4.02E-02
570	5.70E-18	49.89	2.08E-17	50.01	1.73E-18	41.07	2.62E-16	0.85	6.50E-15	0.85	73.73	18.30	2.63	51.20	±	8.96	1.51E-01	1.10E-01
600	1.60E-17	41.60	2.08E-17	50.01	2.99E-18	62.26	3.71E-16	0.63	8.18E-15	0.63	41.36	9.11	4.12	25.68	±	15.01	1.06E-01	1.43E-01
630	5.50E-18	29.81	2.08E-17	50.00	3.34E-18	31.96	5.18E-16	0.52	1.04E-14	0.53	84.05	16.85	6.20	47.21	±	2.63	7.63E-02	8.62E-02
660	6.41E-18	34.13	2.08E-17	50.00	5.00E-18	38.15	7.12E-16	0.34	1.32E-14	0.34	85.40	15.88	9.07	44.54	±	2.55	5.56E-02	7.52E-02
690	7.94E-18	36.96	2.08E-17	50.00	1.29E-17	28.28	1.19E-15	0.30	2.08E-14	0.30	88.44	15.48	13.85	43.42	±	2.05	3.33E-02	2.19E-02
720	3.20E-18	35.98	2.08E-17	50.00	2.39E-17	10.72	2.48E-15	0.23	4.23E-14	0.23	97.58	16.68	23.81	46.74	±	0.42	1.60E-02	2.43E-02
750	6.66E-18	38.68	2.09E-17	50.00	5.48E-17	4.54	4.69E-15	0.21	8.26E-14	0.21	97.43	17.16	42.67	48.06	±	0.48	8.45E-03	5.96E-04
780	8.80E-18	38.61	2.09E-17	50.00	4.06E-17	5.42	3.80E-15	0.21	7.18E-14	0.21	96.19	18.16	57.97	50.83	±	0.76	1.04E-02	1.38E-02
810	9.14E-18	33.69	2.09E-17	50.00	3.20E-17	8.46	2.79E-15	0.22	5.31E-14	0.22	94.71	18.01	69.19	50.41	±	0.92	1.42E-02	6.23E-03
840	3.35E-18	59.86	2.09E-17	50.00	3.35E-17	7.84	2.74E-15	0.23	4.86E-14	0.23	97.78	17.33	80.21	48.55	±	0.63	1.45E-02	7.90E-03
870	4.32E-18	33.07	2.09E-17	50.00	3.38E-17	8.93	2.78E-15	0.23	4.62E-14	0.23	97.04	16.14	91.39	45.26	±	0.45	1.43E-02	6.38E-03
900	5.02E-18	41.48	2.09E-17	50.00	1.53E-17	23.35	1.41E-15	0.27	2.20E-14	0.27	93.02	14.53	97.06	40.78	±	1.23	2.82E-02	1.46E-02
930	6.64E-18	39.87	2.09E-17	50.01	2.68E-18	37.22	2.73E-16	0.79	6.59E-15	0.80	69.84	16.86	98.16	47.23	±	8.02	1.45E-01	7.67E-02
960	4.89E-18	39.70	2.09E-17	50.04	4.93E-18	58.19	9.83E-17	1.95	4.22E-15	1.96	65.33	28.03	98.55	77.88	±	16.20	4.05E-01	3.66E-01
990	4.94E-18	33.14	2.09E-17	50.06	2.76E-18	68.69	8.03E-17	2.40	4.03E-15	2.41	63.37	31.85	98.88	88.22	±	16.80	4.96E-01	1.42E-01
1020	3.65E-18	59.96	2.10E-17	50.09	3.68E-18	83.88	6.07E-17	3.00	3.43E-15	3.00	68.20	38.58	99.12	106.34	±	29.20	6.56E-01	4.72E-01
1050	5.07E-18	38.57	2.10E-17	50.11	3.08E-18	66.21	4.51E-17	3.37	3.07E-15	3.38	50.76	34.60	99.30	95.66	±	35.38	8.84E-01	4.44E-01
1080	9.90E-18	69.06	2.10E-17	50.21	7.00E-19	68.11	3.71E-17	4.53	2.82E-15	4.54	0.01	0.00	99.45	0.00	±	156.65	1.08E+00	5.36E-01
1110	2.26E-18	58.92	2.10E-17	50.46	1.74E-18	59.56	2.88E-17	6.77	2.69E-15	6.78	74.90	69.78	99.57	187.95	±	38.74	1.38E+00	4.24E-01
1140	3.31E-18	35.90	2.10E-17	50.27	7.85E-18	60.71	2.36E-17	5.17	2.53E-15	5.17	60.95	65.54	99.66	177.08	±	41.35	1.70E+00	3.68E+00
1170	4.59E-18	54.82	2.10E-17	50.44	3.47E-19	71.42	2.03E-17	6.60	2.44E-15	6.61	43.76	52.61	99.74	143.49	±	99.29	1.97E+00	4.62E-01
1200	7.49E-18	71.22	2.10E-17	50.53	1.23E-17	53.13	1.43E-17	7.27	2.37E-15	7.27	5.47	9.09	99.80	25.61	±	314.75	2.81E+00	9.35E+00
1250	6.72E-18	56.12	2.10E-17	50.38	2.73E-18	53.85	2.05E-17	6.18	2.50E-15	6.19	19.61	23.96	99.88	66.77	±	152.10	1.96E+00	7.49E-01
1300	4.51E-18	70.47	2.10E-17	50.93	5.87E-18	66.92	1.04E-17	9.68	2.42E-15	9.69	44.29	102.70	99.93	270.28	±	228.91	3.83E+00	5.84E+00
1350	6.47E-18	57.57	2.11E-17	50.98	3.08E-19	93.79	1.09E-17	9.94	2.49E-15	9.95	22.30	50.89	99.97	138.97	±	274.46	3.67E+00	1.19E+00
1450	4.96E-18	39.25	2.11E-17	51.71	5.55E-18	66.32	7.47E-18	13.18	3.64E-15	13.18	59.36	290.30	100.00	678.81	±	196.76	5.37E+00	7.54E+00

Lambda K40=5.5430E-10 *J= 1.5736E-3 ± %0.25*

eArgon analysis on York plot developed from experimental $^{40}Ar/^{39}Ar$ geochronology result



The York plot (b, d) illustrates the progressive degassing pattern during different stages of the temperature-controlled step-heating experiment. The plot enables characterisation of different gas populations and determines which gas population dominates the certain steps in the age spectrum (a, c).

The gas release pattern in white mica from sample IO17-03 and IO17-05 are similar. identifying the presence of two distinct gas populations. Steps indicating gas release from the less retentive argon domain are denoted in red, while blue steps identify the more retentive domain. Note that there is slight mixing when gas release from the less retentive reservoir ends and gas release from the more retentive domain starts (yellow steps) are indicated with the yellow colour.