

GSA Data Repository Item 2017151

Benson, T.R., Mahood, G.A., and Grove, M., 2017, Geology and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology of the middle Miocene McDermitt volcanic field, Oregon and Nevada: Silicic volcanism associated with propagating flood basalt dikes at initiation of the Yellowstone hotspot: GSA Bulletin, doi:10.1130/B31642.1.

DATA REPOSITORY

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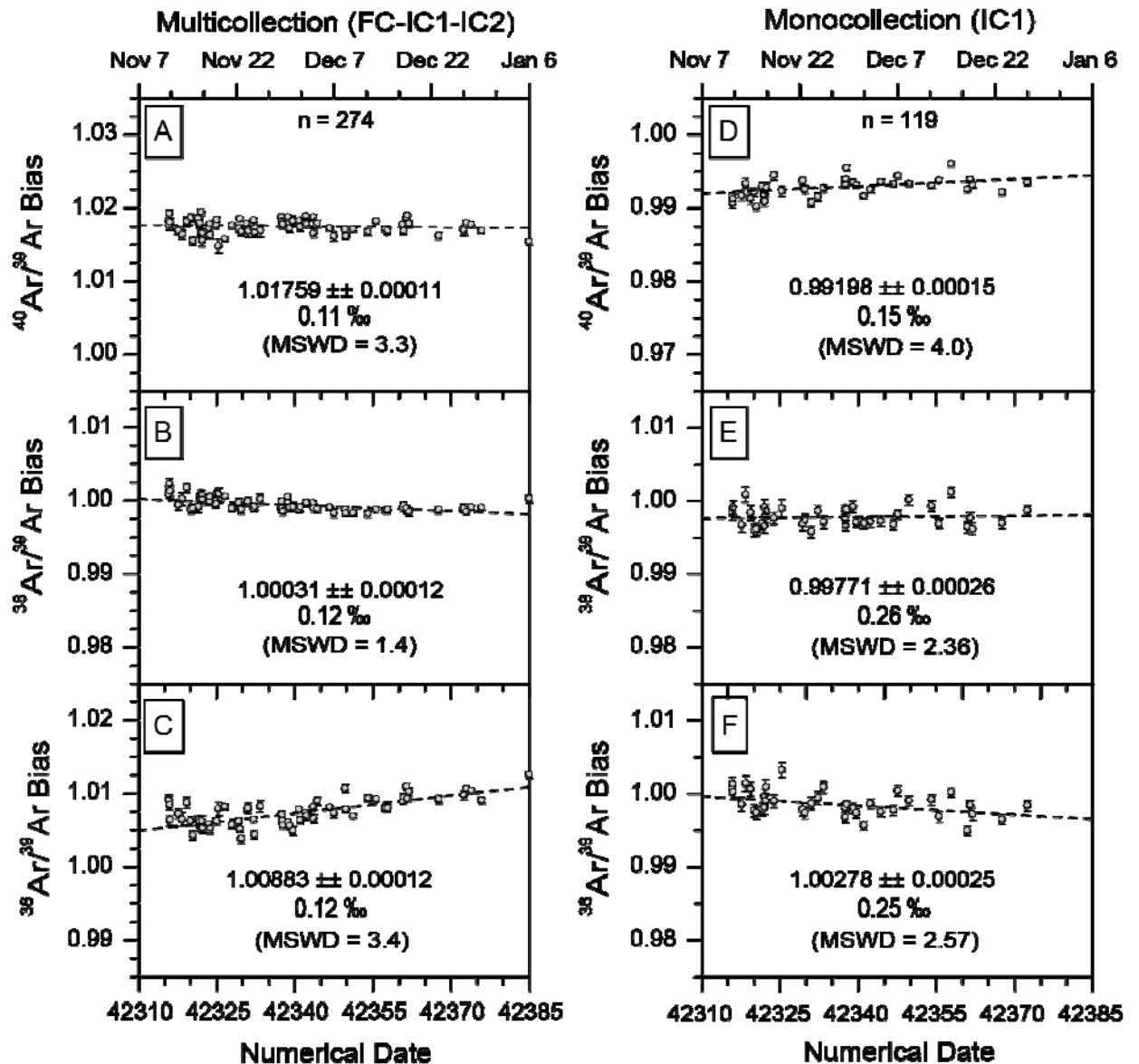
APPENDIX A: METHODS

Field Mapping

Ten months of field work involving geological mapping and sample collection were performed between 2012 and 2015 in the northern MVF and in adjacent areas of northern Nevada and southern Oregon. The majority of mapping was performed at the 1:24,000 scale in northern MVF, field-checking and remapping contacts previously mapped in published 7.5' quadrangles (Rytuba et al., 1982a-g; Rytuba and Curtis, 1983; Rytuba et al., 1983a-b; Peterson and Tegtmeier, 1987; Minor and Wager, 1989; Minor et al., 1989a-c). Our detailed mapping focused on the area around the Whitehorse Caldera of Rytuba et al. (1981) because our initial mapping and analytical work identified a set of older, more peralkaline rhyolite lava domes concentric to those associated with the Whitehorse Caldera. This set up a mapping and sampling strategy for subsequent field work, and led to the identification of two previously unidentified calderas in the map area, the Fish Creek and Pole Canyon calderas, as well as a more accurate delineation of the Whitehorse Caldera topographic and structural margins. The 1:150,000 geological map and cross section of northern McDermitt Volcanic Field (Fig. 6) is the result of the detailed mapping of these calderas. A relatively small amount of time was spent in southern MVF; our observations and conclusions from that area largely build upon the work of Rytuba and McKee (1984), Castor and Henry (2000), Starkel (2014), Henry et al. (2016), and James Rytuba (personal commun., 2012–2016).

Detector Calibration Data

The plot below shows detector calibration data measured over the interval 11/07/2015 - 01/06/2016. No changes were made to instrument source or detector tuning during this interval. The values shown represent the quotient of a true argon isotopic ratio divided by the measured ratio. Each data point represents the mean value and 1σ standard deviation of three successive measurements. Panels (A) thru (C) represent multicollection results from gas aliquots of a reference gas with $^{39}\text{Ar} = 3 \times 10^{-15}$ mol/aliquot. Monocollection measurements performed with smaller aliquots of the same reference gas are shown in panels (D) thru (F). In the each panel, a weighted mean, 2σ standard error, and MSWD have been calculated from the detrended data.



Whole-Rock Geochemistry

We used a suite of relatively immobile major, minor, and trace elements analyzed by tabletop energy-dispersive XRF for the purposes of determining chemical zoning in ignimbrites, correlating isolated outcrops of ignimbrites, and assigning lavas to calderas based on chemical affinities to ignimbrites. About 300 whole-rock samples of lavas and ignimbrites from MVF were crushed with a sledgehammer and powdered to less than 175 μm in an alumina ceramic grinding container using a SPEX shatterbox. Powders were analyzed using a Spectro Xepos He ED-XRF Spectrometer at Stanford University, and concentrations were determined using two separate calibrations with respect to USGS and internal standards: one for mafic to intermediate volcanic rocks and one for intermediate to felsic volcanic rocks¹. Repeat analyses of samples for each calibration yielded reproducibility within 2% and concentrations agree with external

standard values within ~5% on average. ED-XRF data appear in Appendices G and H, with separate tabs in each file demonstrating agreement of measured values with accepted values for external standards.

Powders of representative samples were analyzed for major, minor, and trace elements via WD-XRF at Franklin and Marshall College. Results agree with ED-XRF values within 10% for most elements. WD-XRF data appear in Appendix F with a separate tab demonstrating the agreement of WD-XRF with ED-XRF data for a subset of the samples.

Electron Microscopy

Mineral separates were mounted in epoxy, polished, and analyzed at the U.S. Geological Survey in Menlo Park, California: feldspar with 15 kV accelerating voltage and 10–30 nA beam current using the JEOL 8900 electron microprobe, and mafic minerals using EDS on the Tescan VEGA3 scanning electron microscope. Feldspar compositions appear in Appendix E.

Estimation of Volumes of Tuffs and Lavas of McDermitt Volcanic Field

Calculation of volumes of caldera-forming eruptions typically involves summation of the volumes of intracaldera ignimbrite, outflow ignimbrite, and plinian fall deposits, surges, and co-ignimbrite fall deposits associated with the eruption (e.g., Rose and Chesner, 1987; Wilson, 2001; Mason et al., 2004; Cook et al., 2016). Such an approach is not feasible for MVF, given that non-welded portions of the eruptive products are not preserved except where overlain by densely welded tuff or younger lava flows.

Instead, we provide rough estimates for intracaldera volume by taking the area of the mapped calderas and multiplying them by an estimated 1 km thickness for the calderas more than 15 km in diameter (Fish Creek, Pole Canyon, and McDermitt calderas) and 0.5 km for the smaller Whitehorse Caldera. We use 1 km for the larger calderas because that is the approximate thickness of intracaldera tuff exposed in the similarly sized Mid-Miocene Rooster Comb Caldera of the Lake Owyhee Volcanic Field (Benson and Mahood, 2016) and the similarly alkali rhyolite Otowai member of Bandelier Tuff from similarly-sized Valles Caldera (Cook et al., 2016). We assume that the intracaldera tuff in these calderas is densely welded and therefore do not adjust for dense rock equivalence. We use a thickness of 0.5 km for Tuff of Whitehorse Creek, given its smaller diameter and drilling results near the edge of the caldera where only few hundred meters of tuff were encountered. Many assumptions are involved in this estimate, including the degree of intracaldera welding and the possibility that collapse is trapdoor or piecemeal (e.g., Lipman, 1997), any combination of which may have occurred during eruption of the tuffs of Oregon Canyon, Trout Creek Mountains, Long Ridge, and Whitehorse Creek given our physical and chemical observations. We stress that our calculations of intracaldera volumes are only rough estimates.

We adopt a similar approach to Wilson (2001) to estimate the volume of outflow tuff by taking the aerial extent of outflow ignimbrite and multiplying it by the average thickness of the sheet. We do not favor an estimation based on isopach maps of the outflow sheet because our mapping has shown that the thicknesses of tuffs do not uniformly decrease with distance from the vents due to the significant paleotopographic relief imposed by basaltic and trachyandesitic shield volcanoes that now form the Oregon Canyon and Trout Creek mountains. For example, in the northern Trout Creek Mountains, barely any Tuff of Long Ridge is exposed atop the

topographic high formed by pre-Tuff-of-Oregon-Canyon mafic and intermediate lavas, yet 5 km to the east, in the paleovalley between the trachyandesitic stratocones of the Trout Creek and Oregon Canyon Mountains, the tuff reaches thicknesses as great as 30 m.

Given that few ash fall or surge deposits are preserved in MVF, we cannot use empirical methods to estimate the volume of co-ignimbrite fall and surge deposits (e.g., Pyle, 1989; Fierstein and Nathenson, 1992; Bonadonna and Houghton, 2005). Some workers suggest using a ratio of outflow:fall deposits of 1:1 (Sparks and Walker, 1977; Mason et al., 2004), while others recommend that this ratio be used with caution (Cook et al., 2016). Where volumes have been estimated in detail in younger, well-preserved systems, this ratio is accurate within an order of magnitude (1000:800 in the Toba Tuff; Rose and Chesner, 1987; 320:430 in the Oruanui Tuff; Wilson, 2001; 89:65 in the Otowai member of the Bandelier Tuff; Cook et al., 2016). However, given that eruptions of peralkaline silicic magmas generally result in fall deposits of limited aerial extent (Mahood, 1984) and less fine ash that can be elutriated from pyroclastic flows, we conservatively approximate the volume of fall deposits as 25% of the outflow volume.

As listed in Table 3, we estimate the volumes of tuffs sourced from MVF as 510 km³ (Tuff of Oregon Canyon), 660 km³ (Tuff of Trout Creek Mountains), 1080 km³ (Tuff of Long Ridge, and 110 km³ (Tuff of Whitehorse Creek). These estimates are in close agreement with the estimates of Rytuba and Conrad (1981), Rytuba and McKee (1984), and Henry et al. (2016).

Estimating the volume of rhyolite lavas is more straightforward because lavas are more resistant to erosion than nonwelded tuffs. The rhyolite lavas form edifices that are roughly conical in shape; hence, their volumes can be estimated by calculating the volume of a cone using the height and approximate radius of the lava dome. Table 3 lists the approximate volumes of rhyolite lavas in McDermitt Volcanic Field using this method.

To obtain the volume of moderate-viscosity intermediate lavas, we combined the 400 km³ estimated for the shield volcanoes in the Trout Creek and Oregon Canyon Mountains, modeled as idealized cones centered at the summits of each mountain range, and ~10 km³ of erupted from many vents over an area of ~100 km² in the vicinity of Tule Rims (Table 3), for a total of 410 km³.

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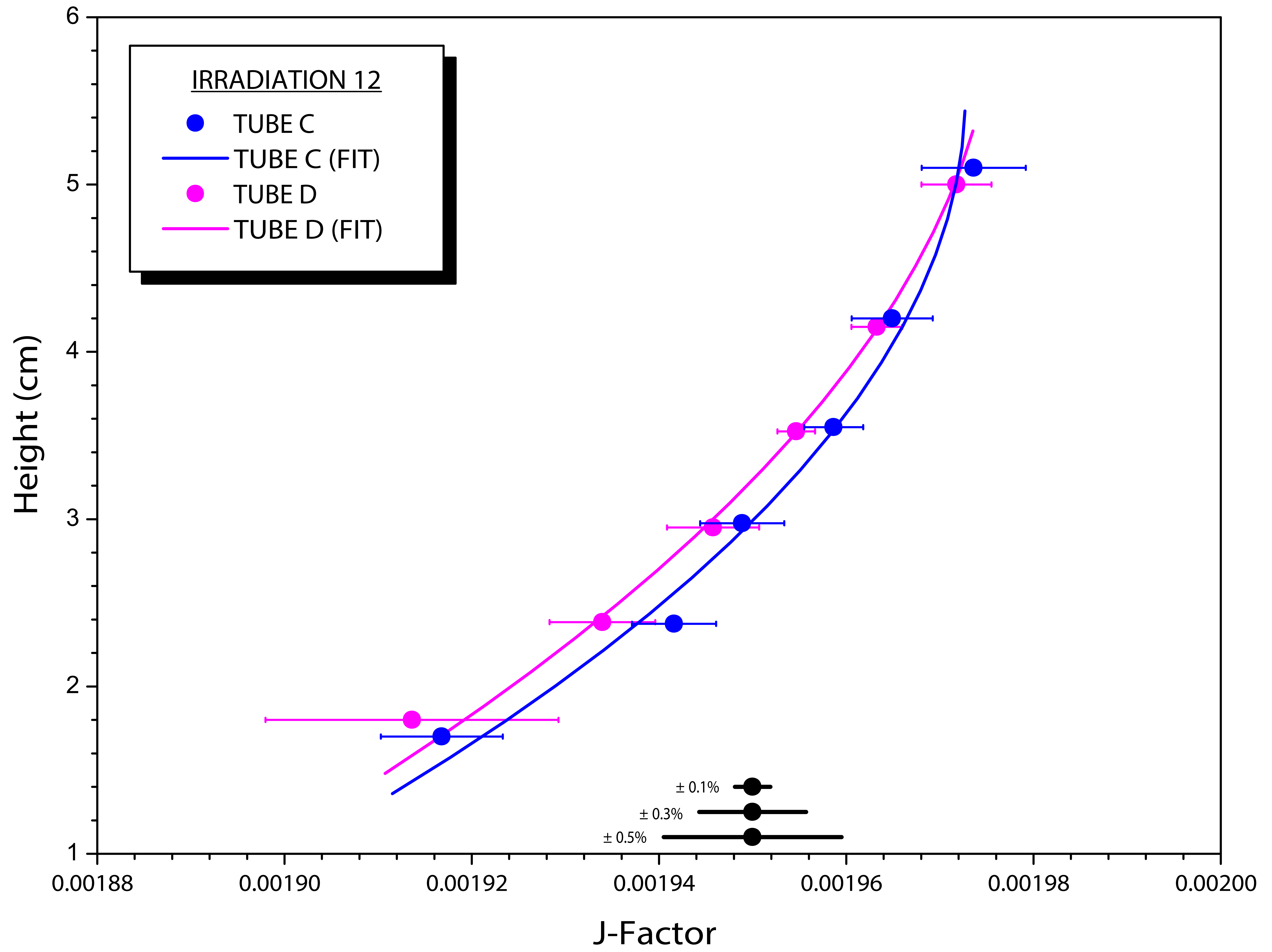
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¹Calibrated elements include: CaO, TiO₂, MnO, FeO*, Cu, Zn, Ga, Rb, Sr, Y, Zr, Nb, Ba, La, Ce, Nd, Th, U (felsic calibration) and P₂O₅, K₂O, CaO, TiO₂, FeO*, V, Cr, Ni, Cu, Zn, Sr, Y, Zr, Nb, Ba, Ce (mafic calibration).

Appendix B: J-factor curves from Irradiation 12



Appendix C: Detailed $^{40}\text{Ar}/^{39}\text{Ar}$ Data

Notes on Appendix C:

Tabs in this Appendix are organized by Irradiation ID.

All reported ages are calculated relative to a Fish Canyon sanidine age of 28.02 Ma and a decay constant of $\lambda = 5.543 \times 10^{-10}/\text{yr}$ (Steiger and Jäger, 1977).

* indicates grains excluded from calculation of inverse isochron age

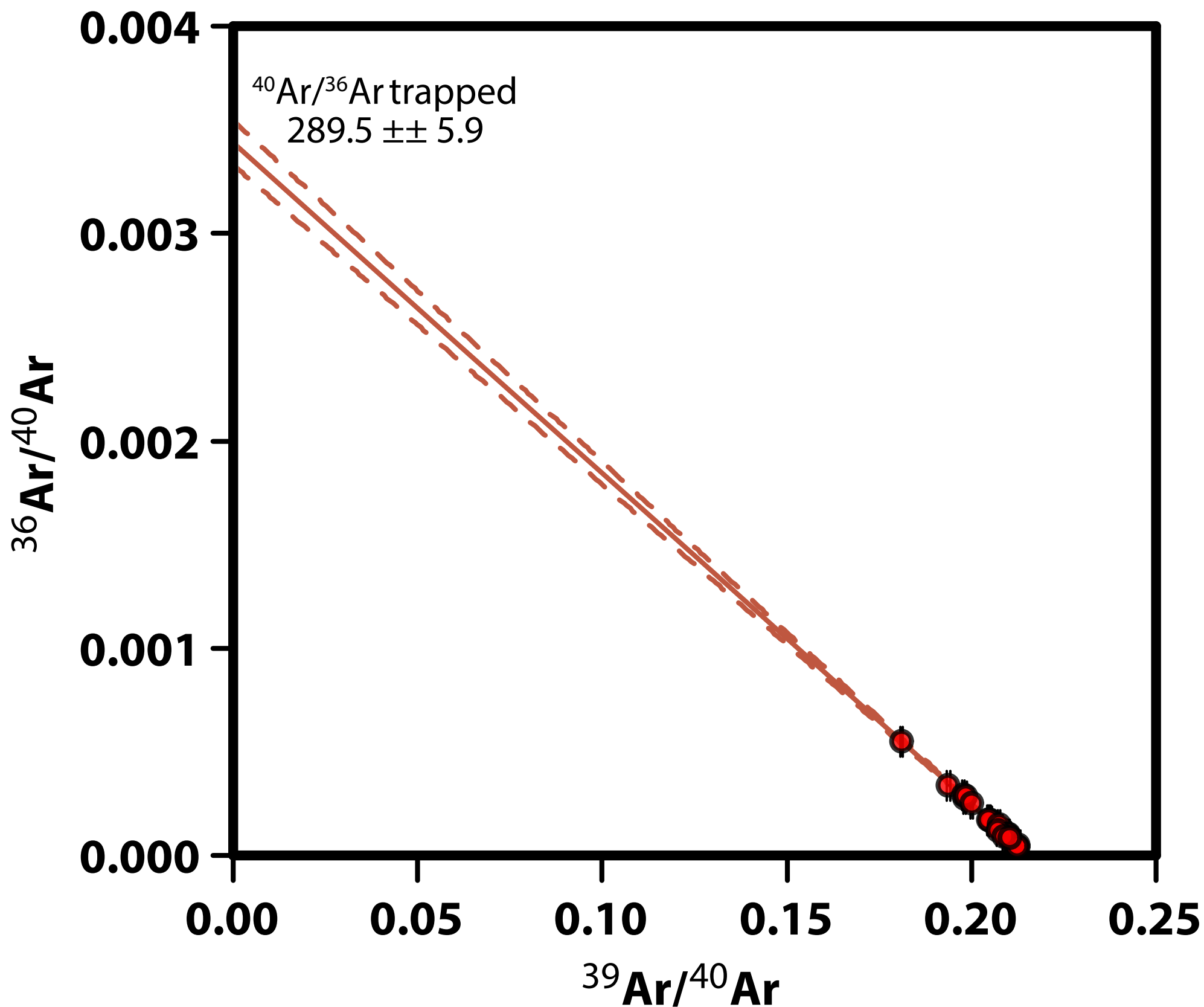
Inverse isochron plots and atmospheric ratios used for each sample appear in Appendix D: Isochron Plots

Irradiation constants:

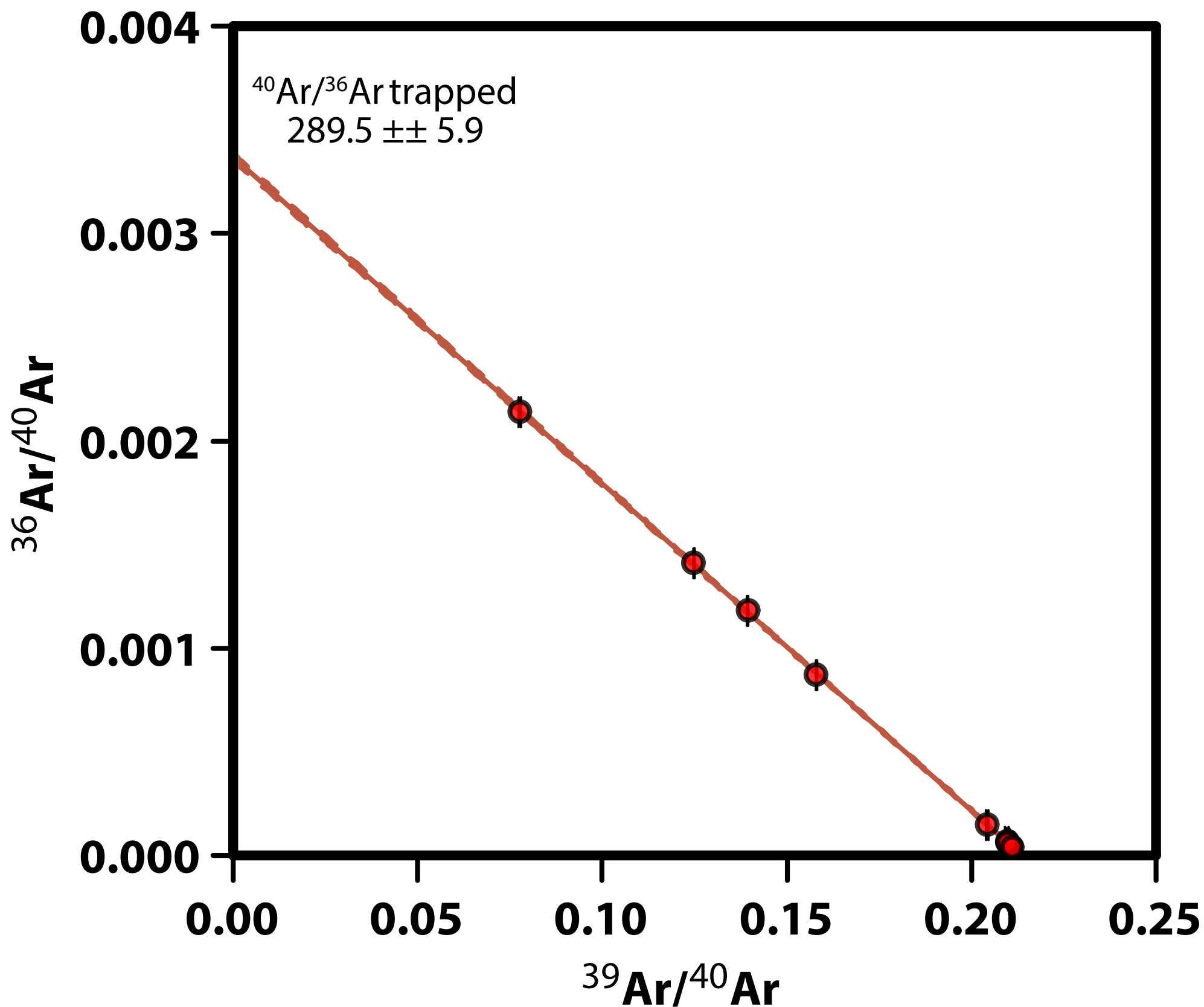
$^{40}\text{Ar}/^{39}\text{ArK}$ Correction Factor:	$7.23\text{E-}03 \pm$	$7.84\text{E-}04$
$^{38}\text{Ar}/^{39}\text{ArK}$ Correction Factor:	$1.27\text{E-}02 \pm$	$1.70\text{E-}05$
$^{36}\text{Ar}/^{37}\text{ArCa}$ Correction Factor:	$2.84\text{E-}04 \pm$	$4.00\text{E-}06$
$^{39}\text{Ar}/^{37}\text{ArCa}$ Correction Factor:	$7.09\text{E-}04 \pm$	$2.21\text{E-}06$

Tuff of Long Ridge (EW-210)

$16.305 \pm \pm 0.022$ Ma

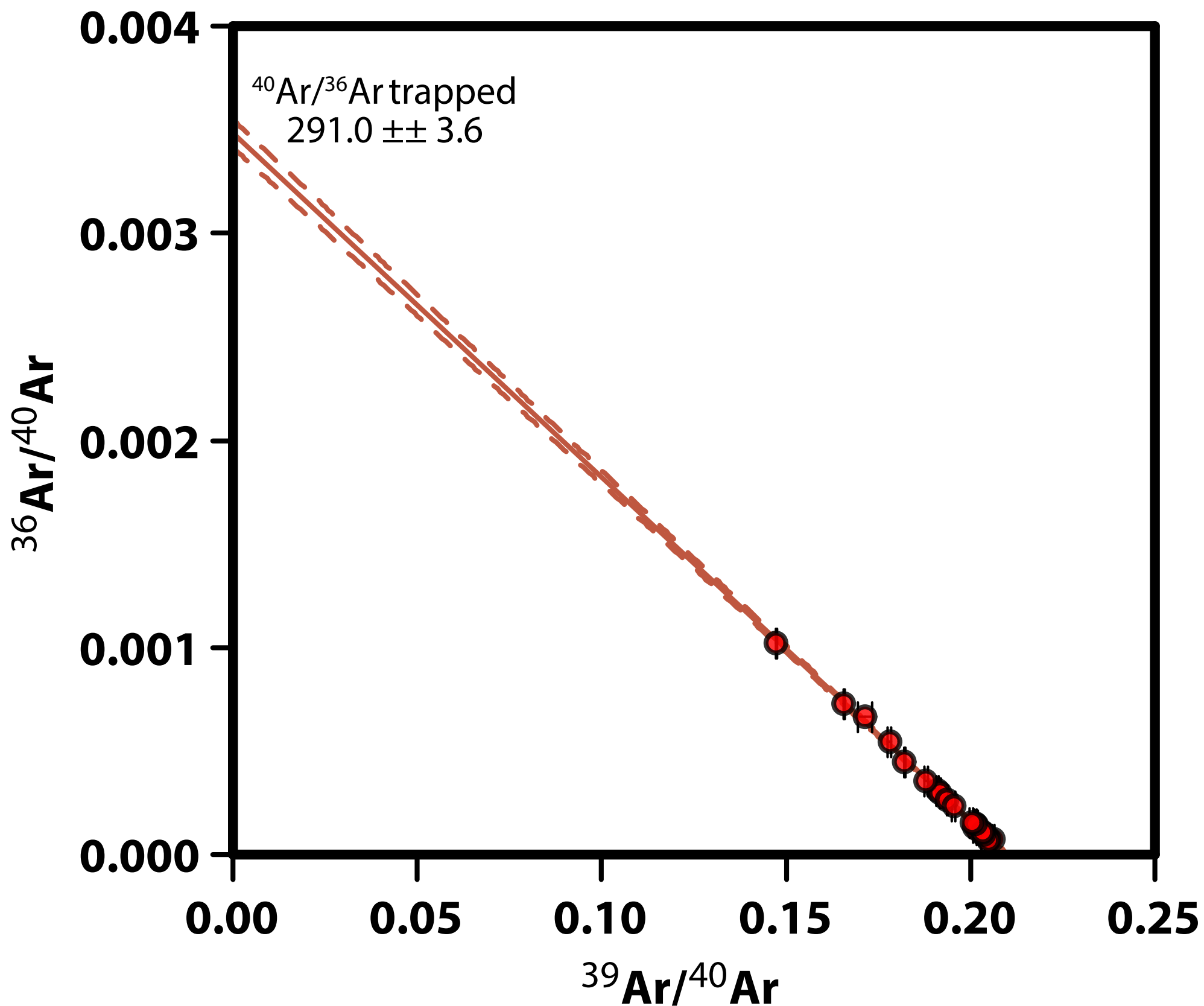


Tuff of Trout Creek Mtns (EW-210)
16.305 \pm 0.022 Ma



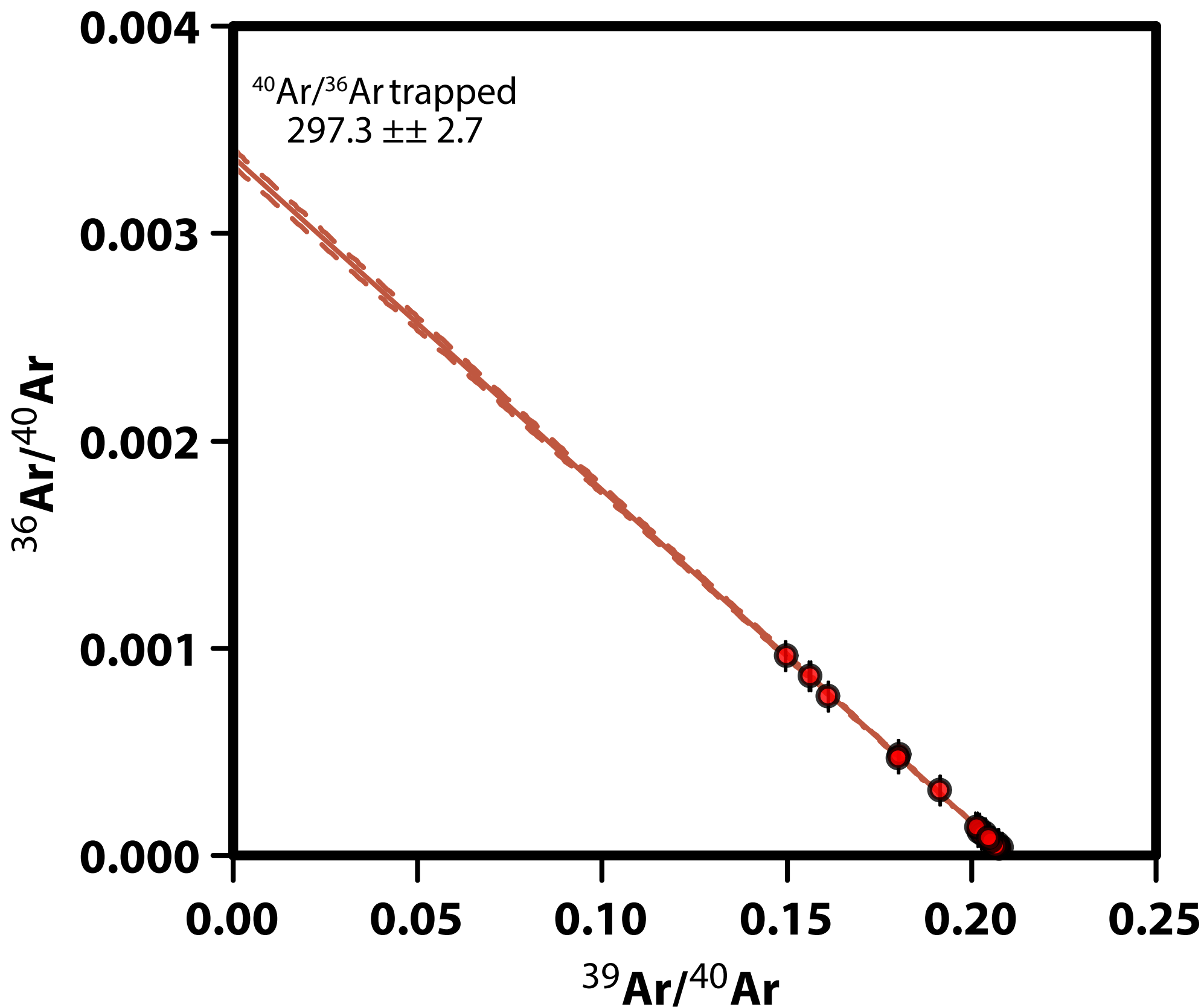
Tuff of Oregon Canyon (MC-407B)

$16.484 \pm \pm 0.022$ Ma



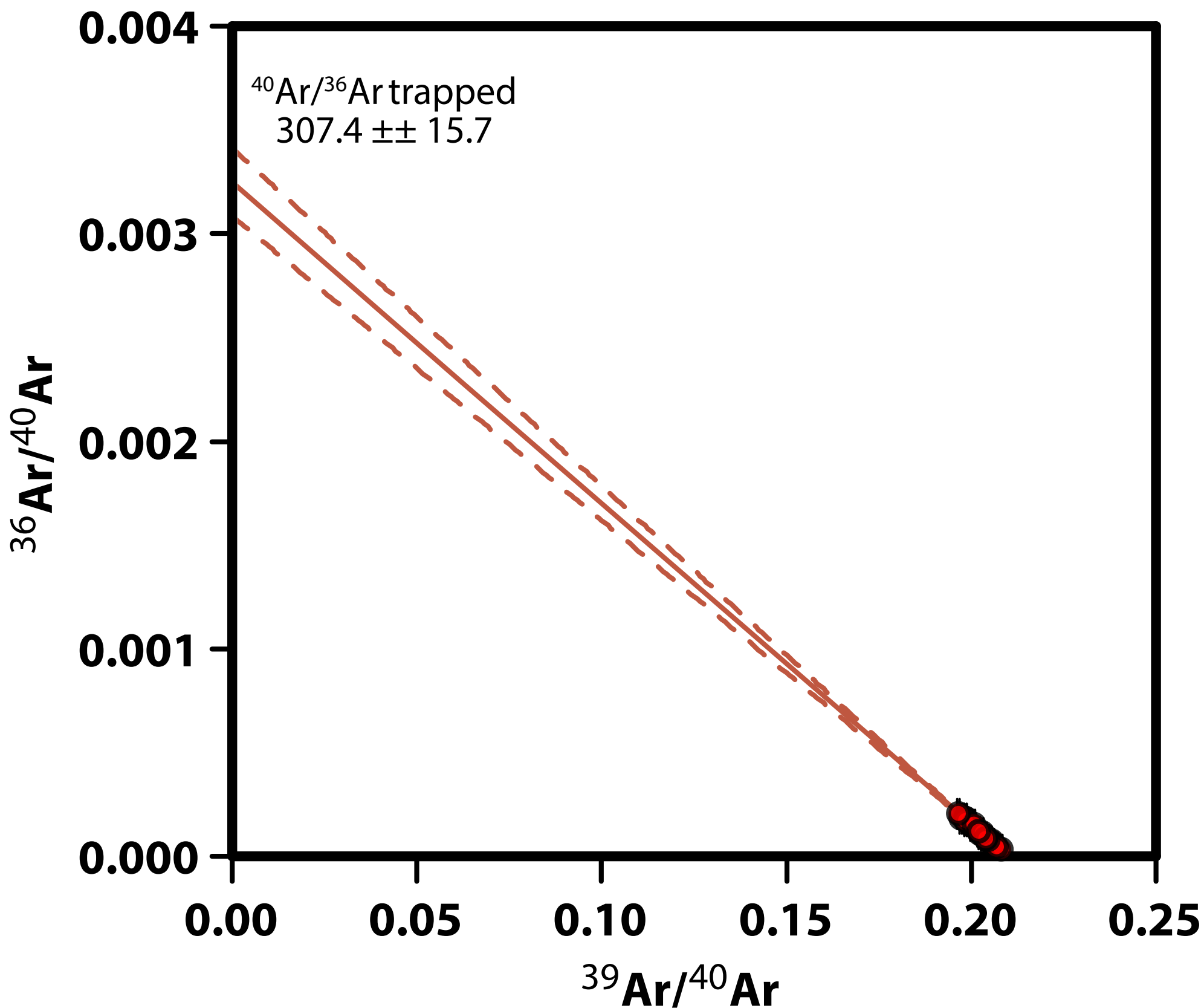
Tuff of Oregon Canyon (ML-304)

$16.494 \pm \pm 0.017$ Ma

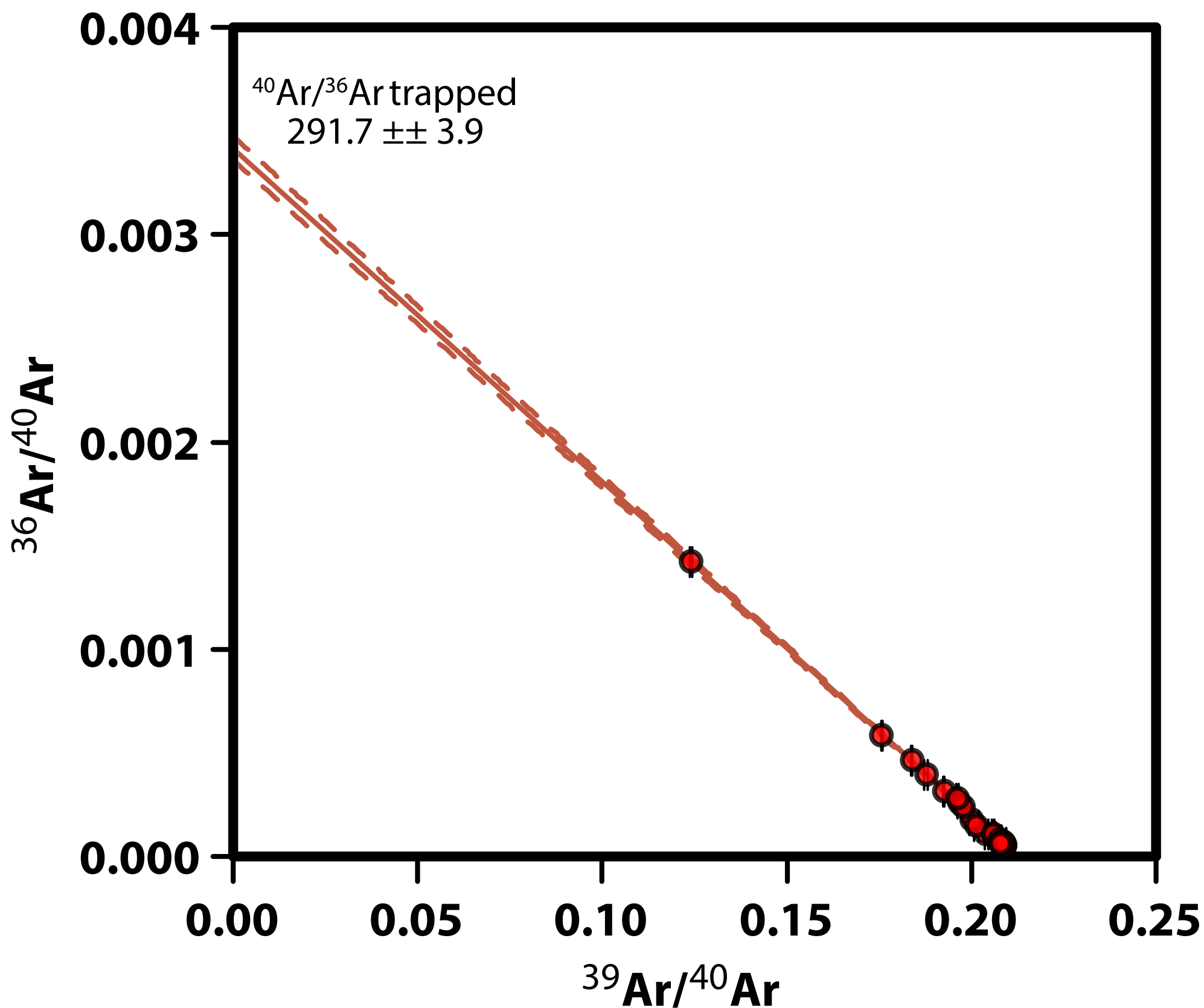


Tuff of Oregon Canyon (TB-224)

$16.467 \pm \pm 0.033$ Ma

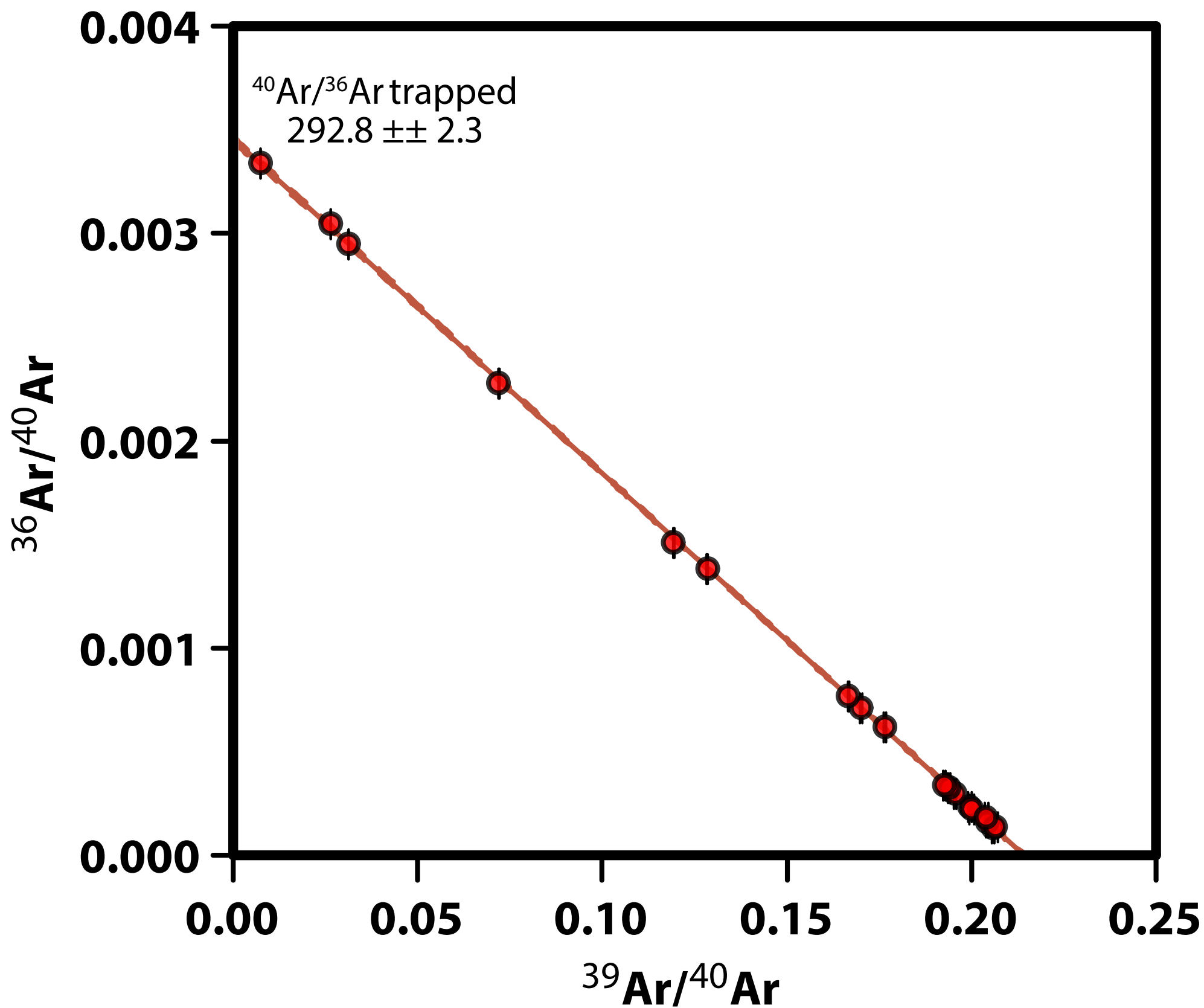


Tuff of Trout Creek Mtns (TB-225A)
16.423 \pm 0.021 Ma



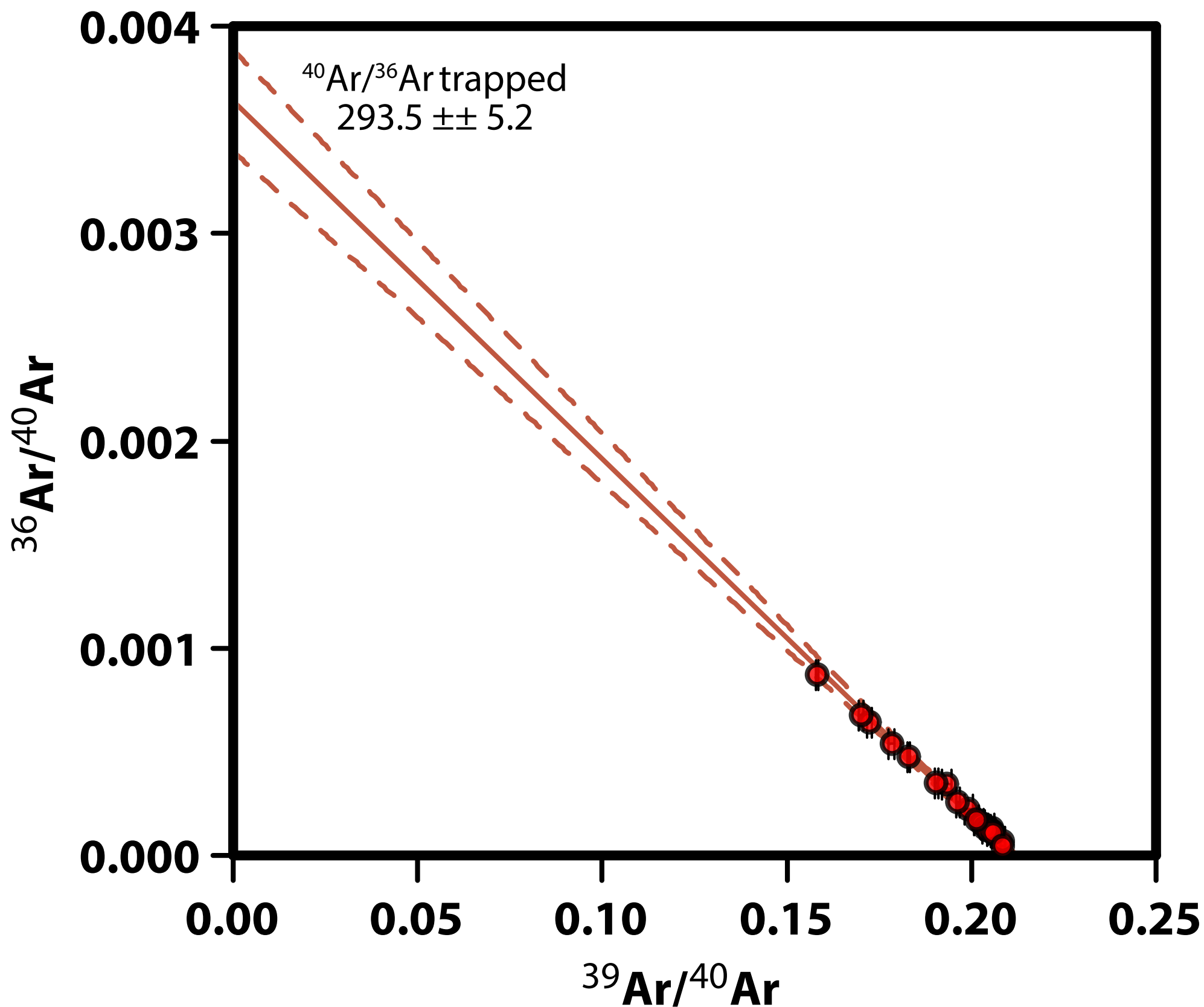
Tuff of Long Ridge (TB-226)

$16.353 \pm \pm 0.031$ Ma

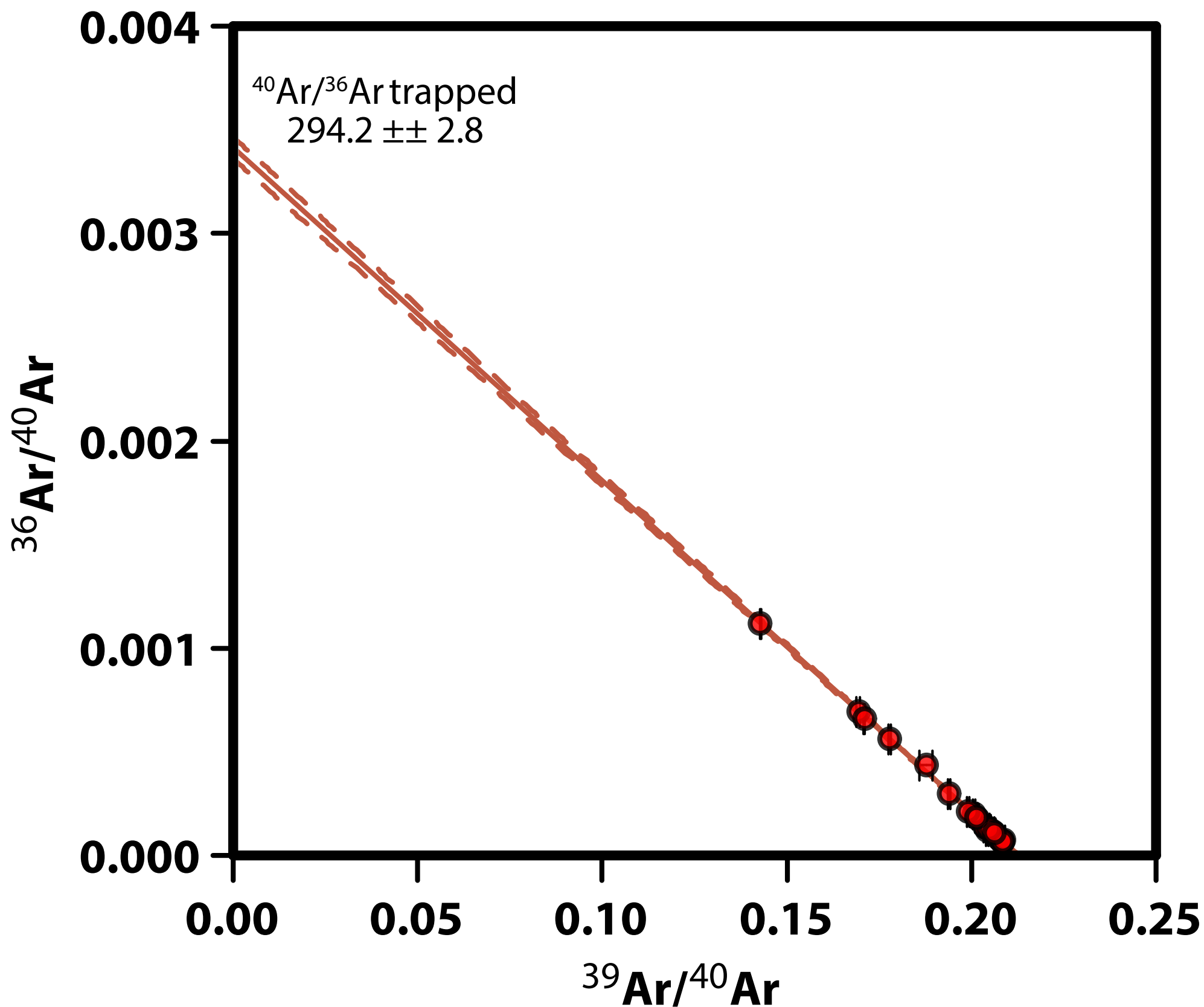


Tuff of Oregon Canyon (TB-264)

$16.497 \pm \pm 0.036$ Ma

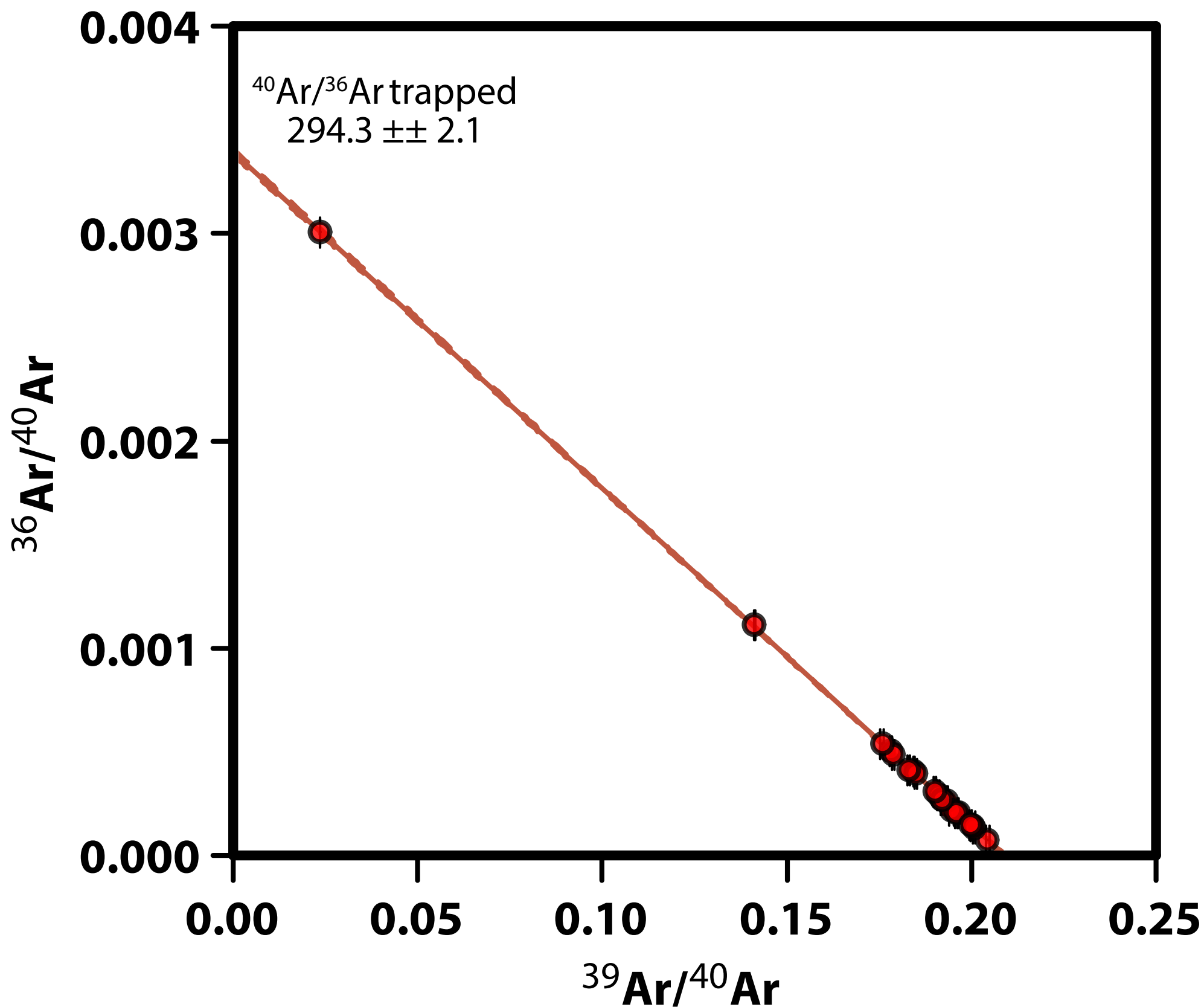


Tuff of Trout Creek Mtns (TB-265B)
16.412 \pm 0.017 Ma



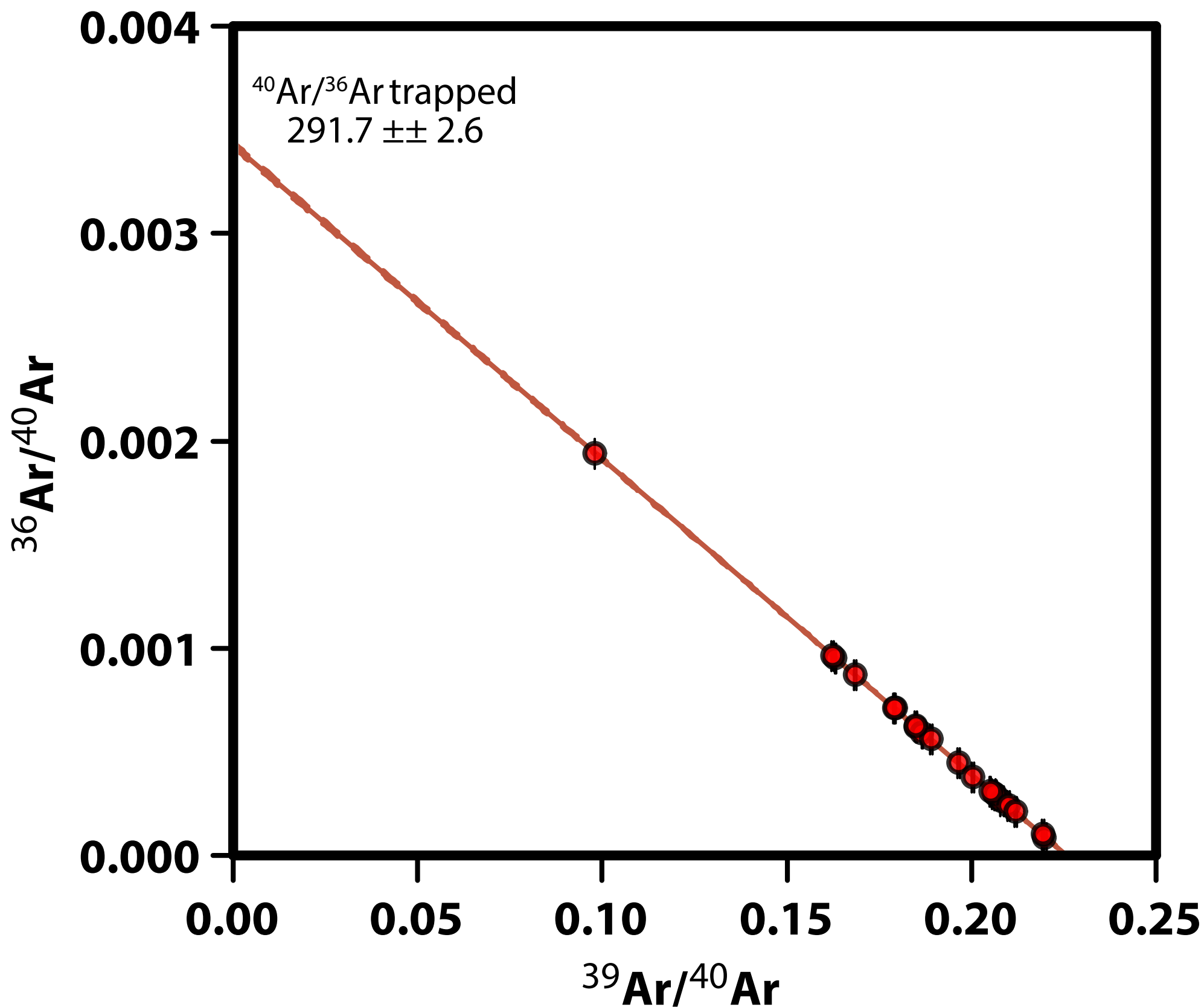
N. Red Mountain rhyolite lava (TB-266)

$16.526 \pm \pm 0.022$ Ma



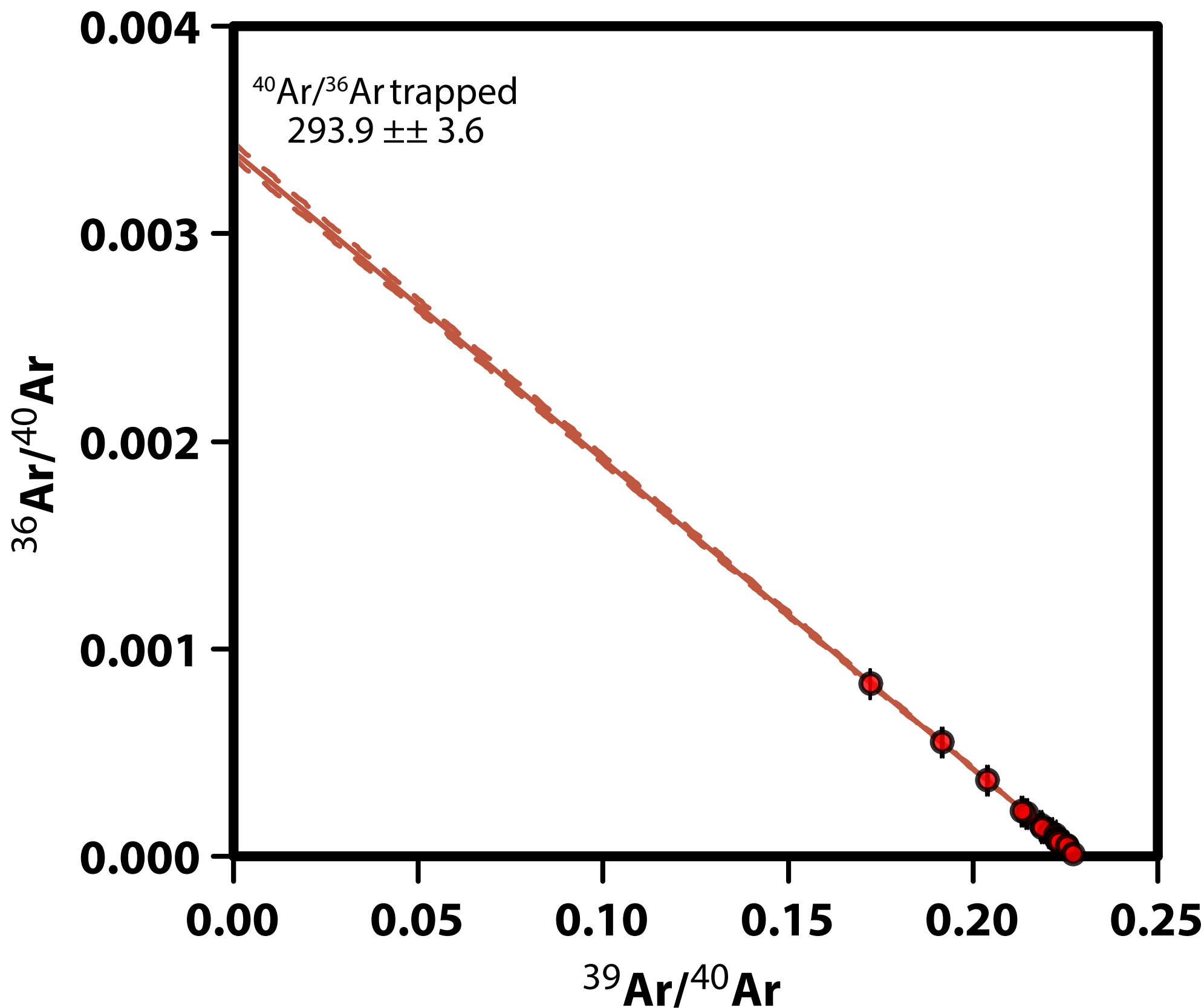
Camp turnoff rhyolite lava (TB-307)

$15.592 \pm \pm 0.028$ Ma



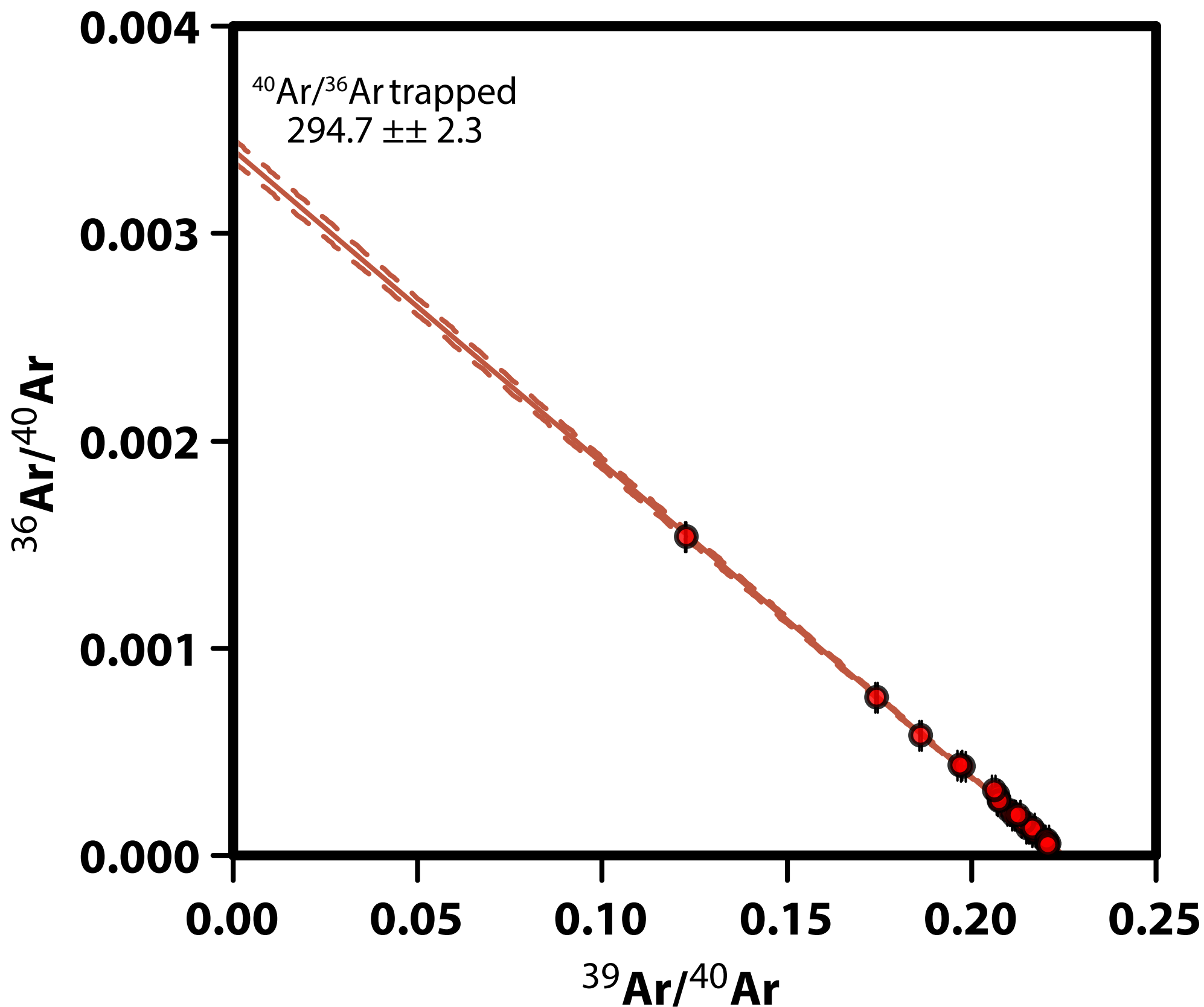
Buckskin Mtn hornblende rhyolite lava (TB-317)

15.369 \pm 0.015 Ma



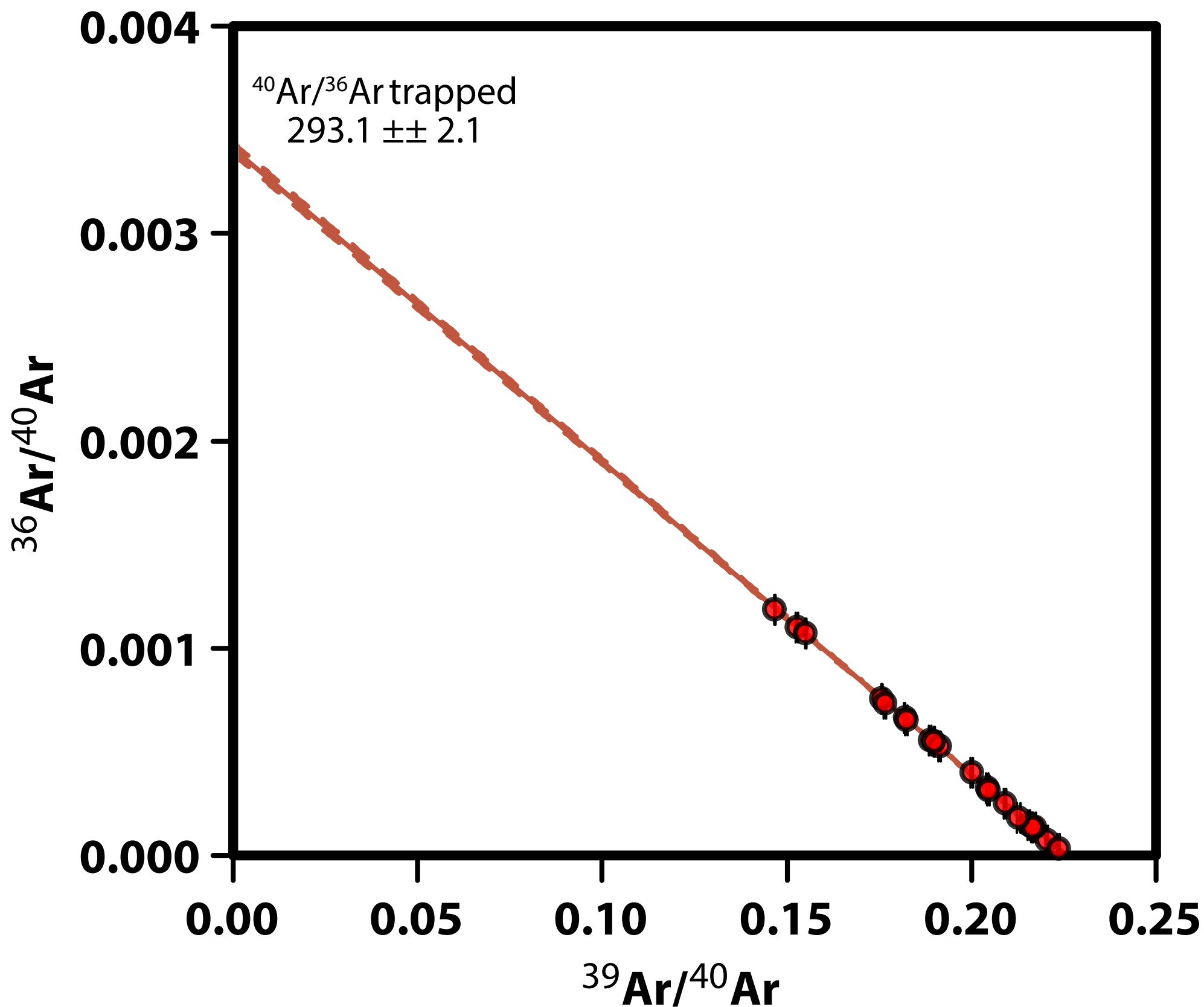
Flagstaff Butte rhyolite lava (TB-318)

$15.510 \pm \pm 0.023$ Ma



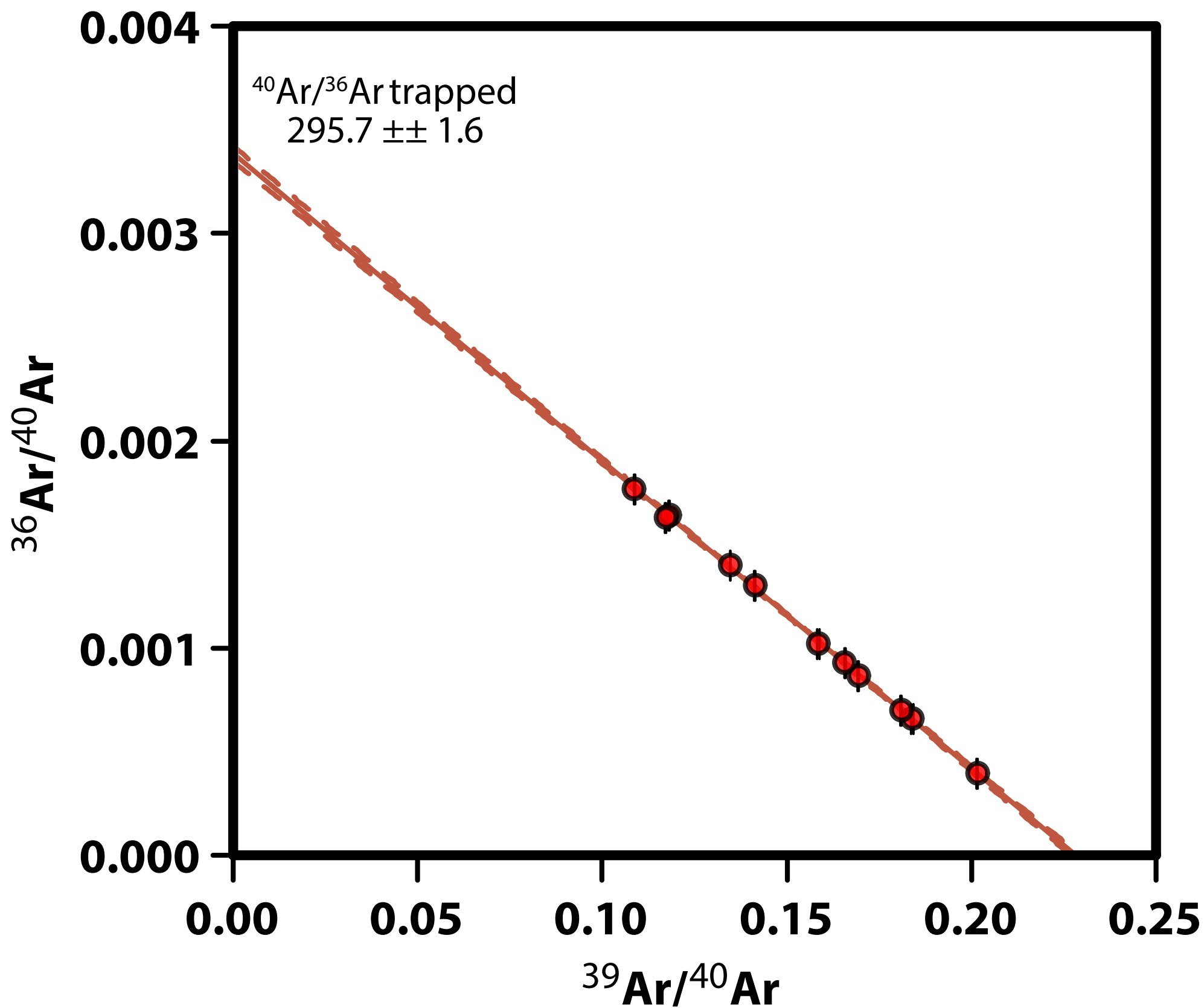
N. Whitehorse Butte rhyolite lava (TB-320)

$15.575 \pm \pm 0.023$ Ma

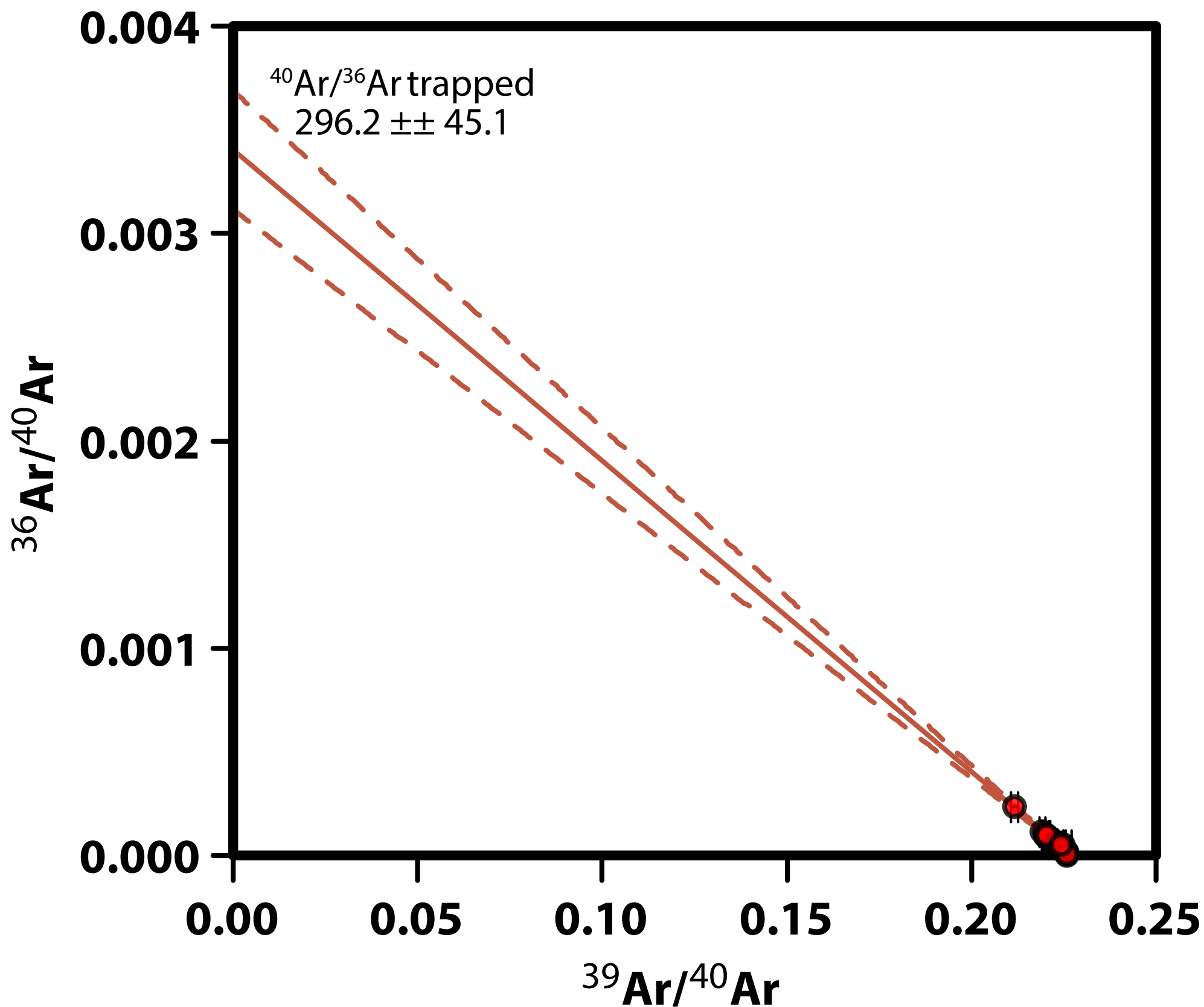


S. camp rhyolite lava (TB-321)

$15.435 \pm \pm 0.043$ Ma

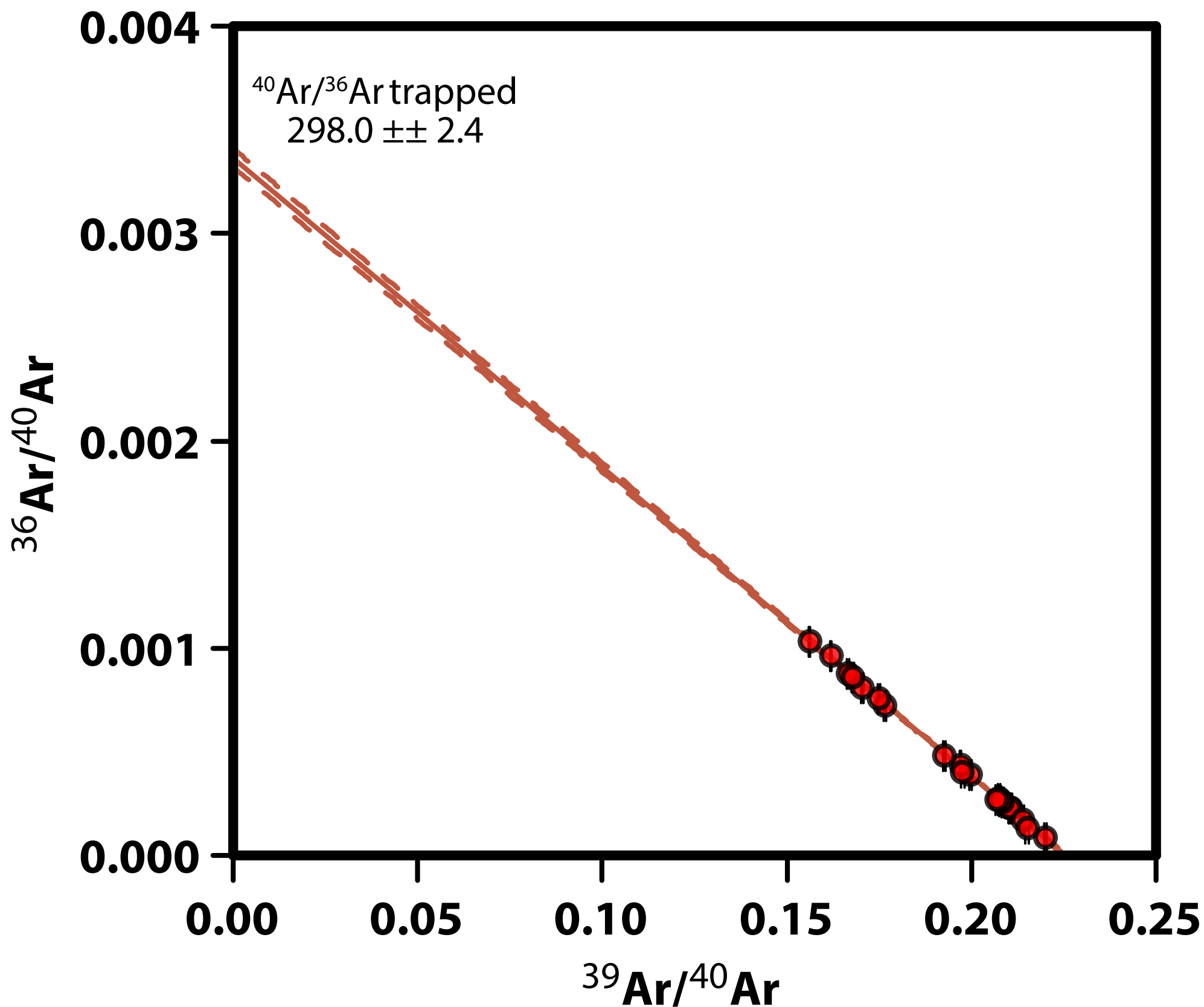


Tuff of Whitehorse Creek (TB-322)
 $15.559 \pm \pm 0.044$ Ma



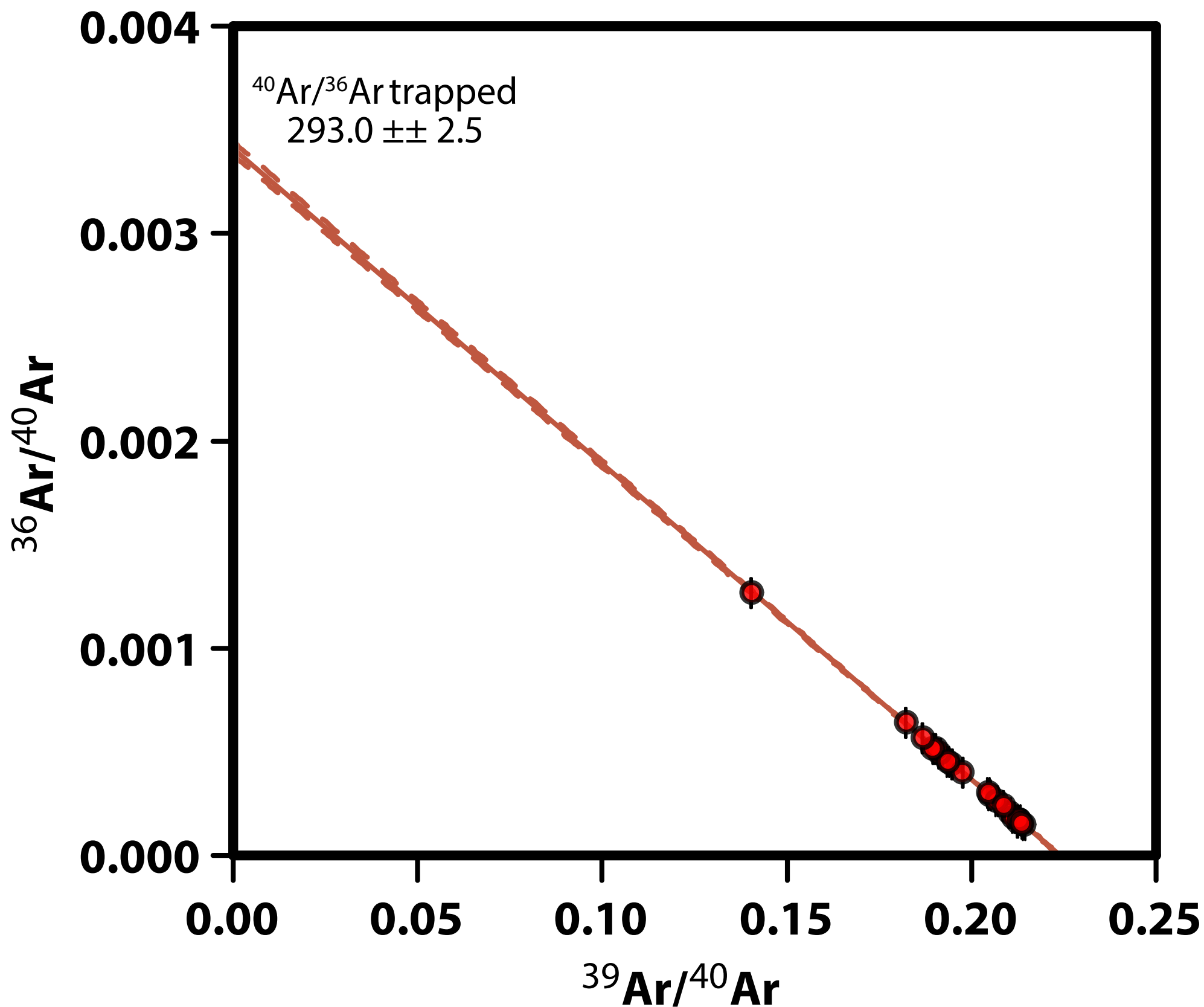
N. Flagstaff Ranch rhyolite lava (TB-331)

$15.570 \pm \pm 0.023$ Ma



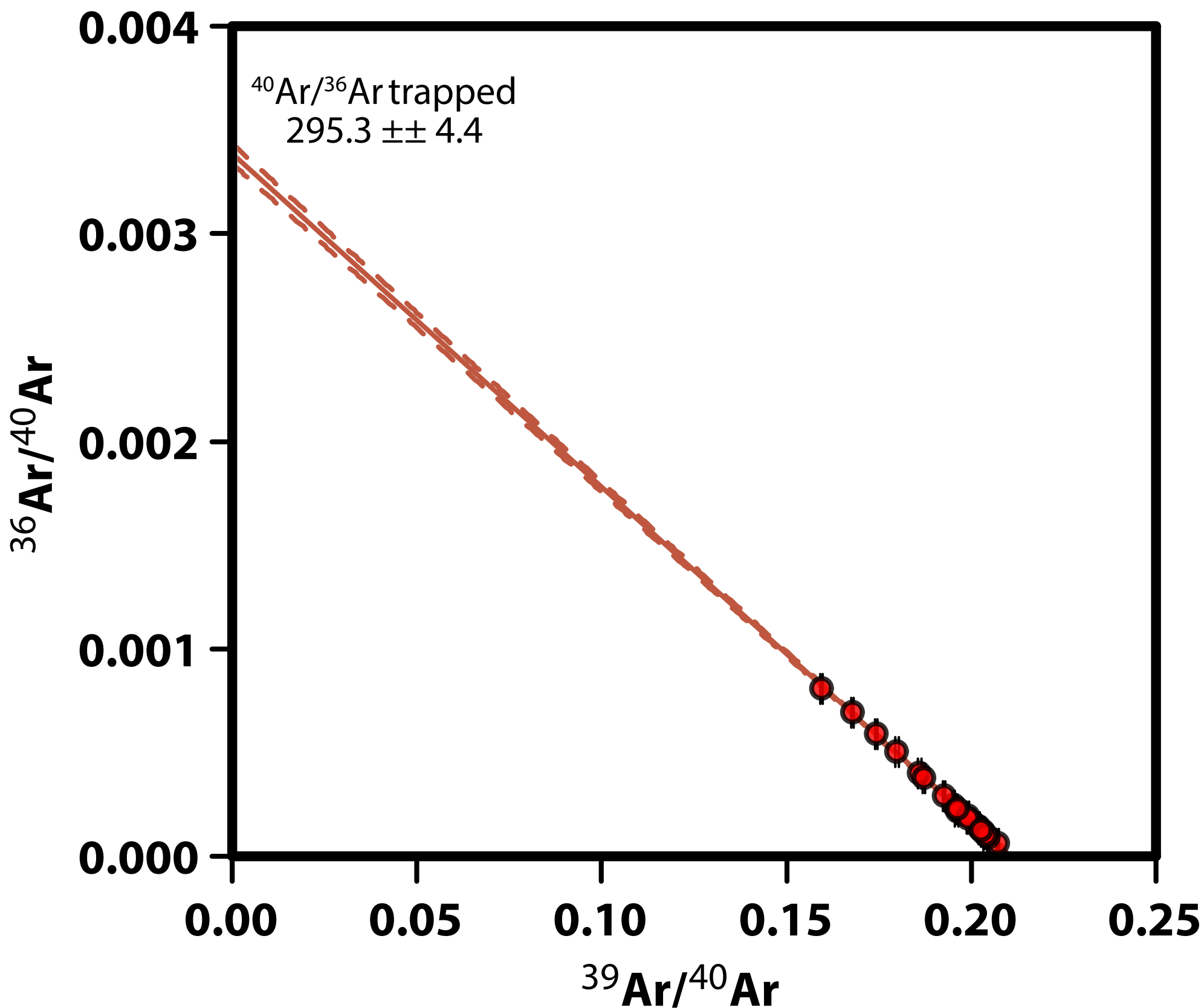
Whitehose Butte rhyolite lava (TB-342)

15.581 \pm 0.021 Ma



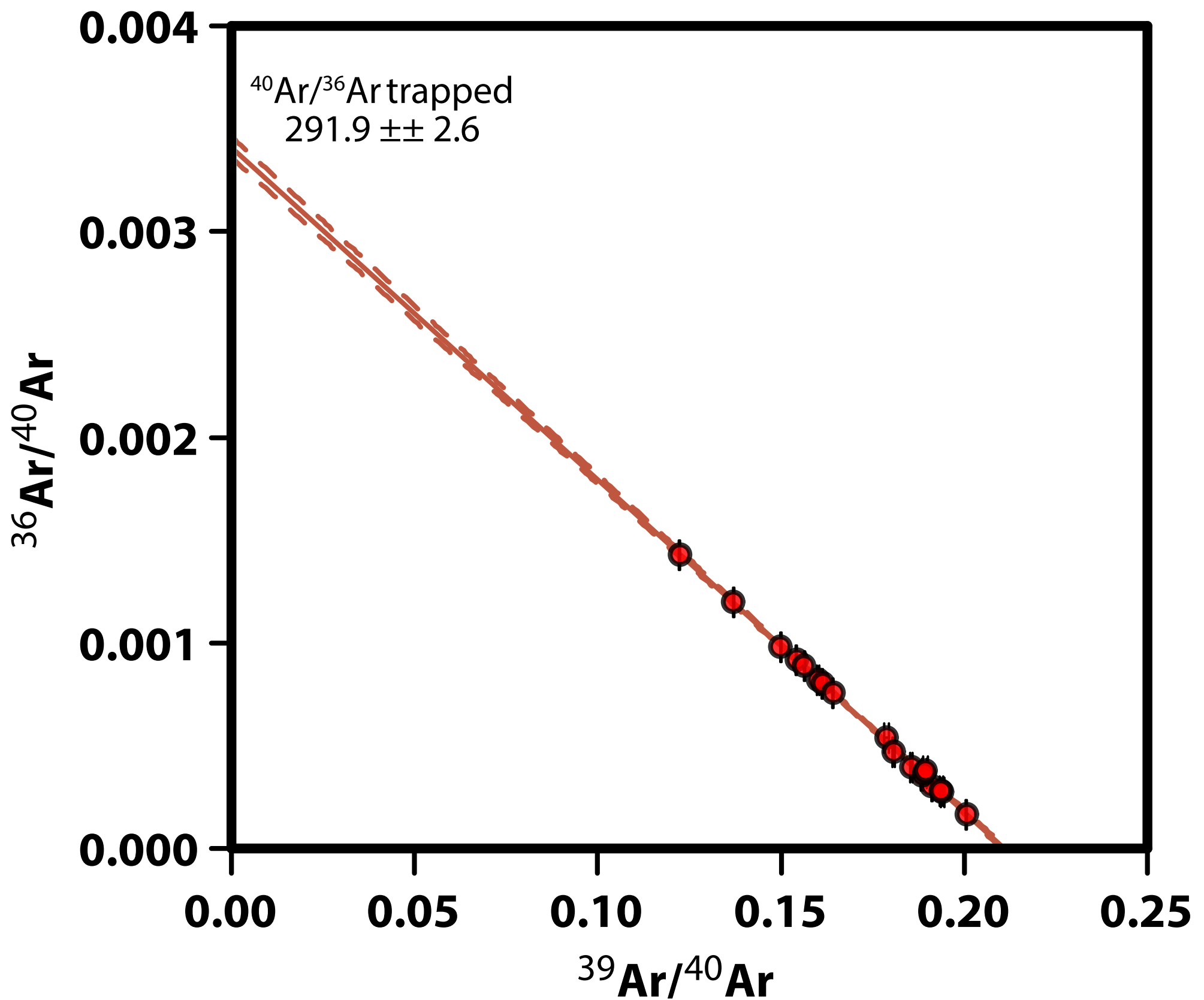
Fish Creek rhyolite lava (TB-354)

16.445 \pm 0.022 Ma



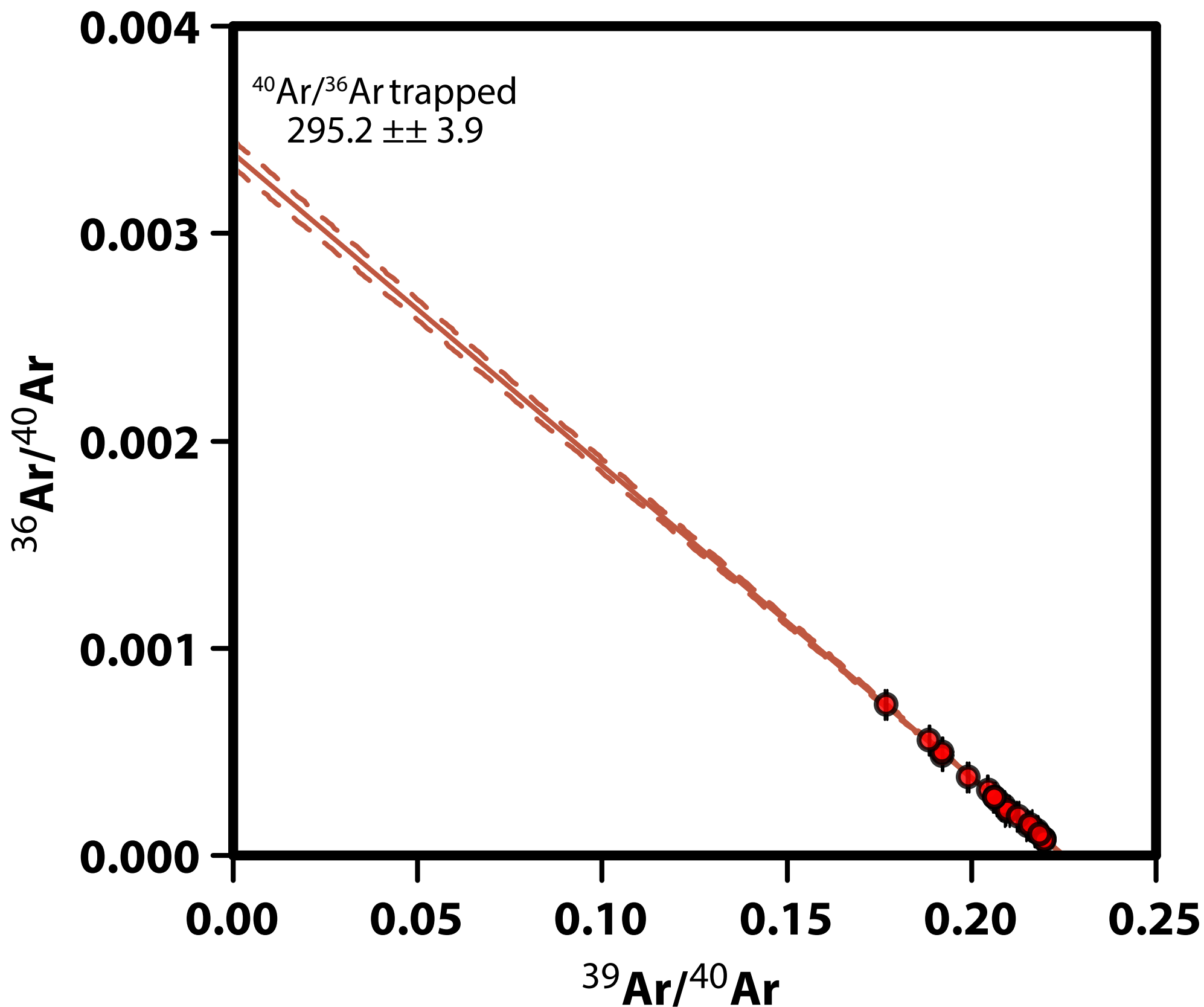
Whitehorse Cyn rhyolite lava (TB-355)

$16.539 \pm \pm 0.039$ Ma



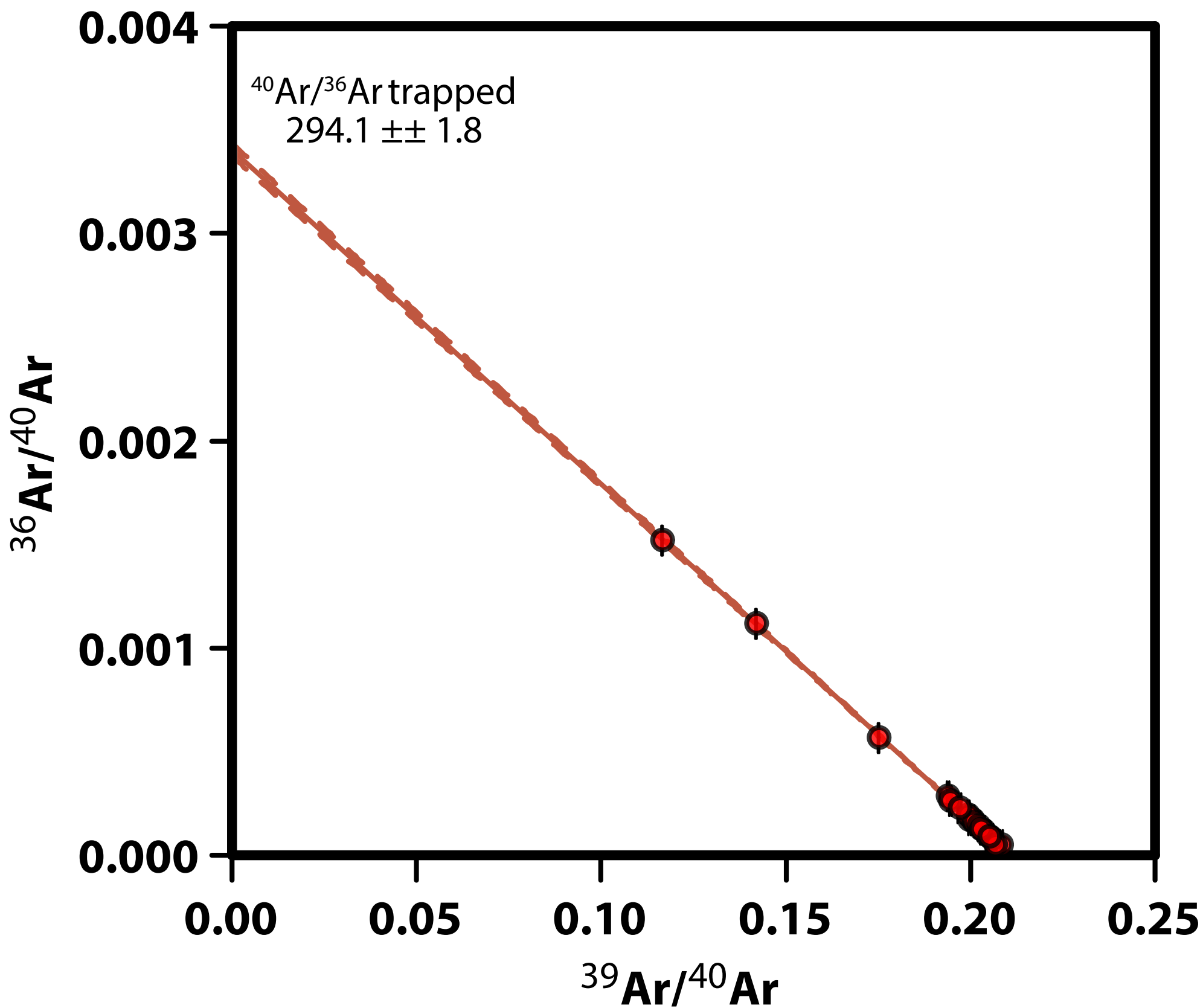
Bearclaw rhyolite lava (TB-362A)

$15.540 \pm \pm 0.022$ Ma



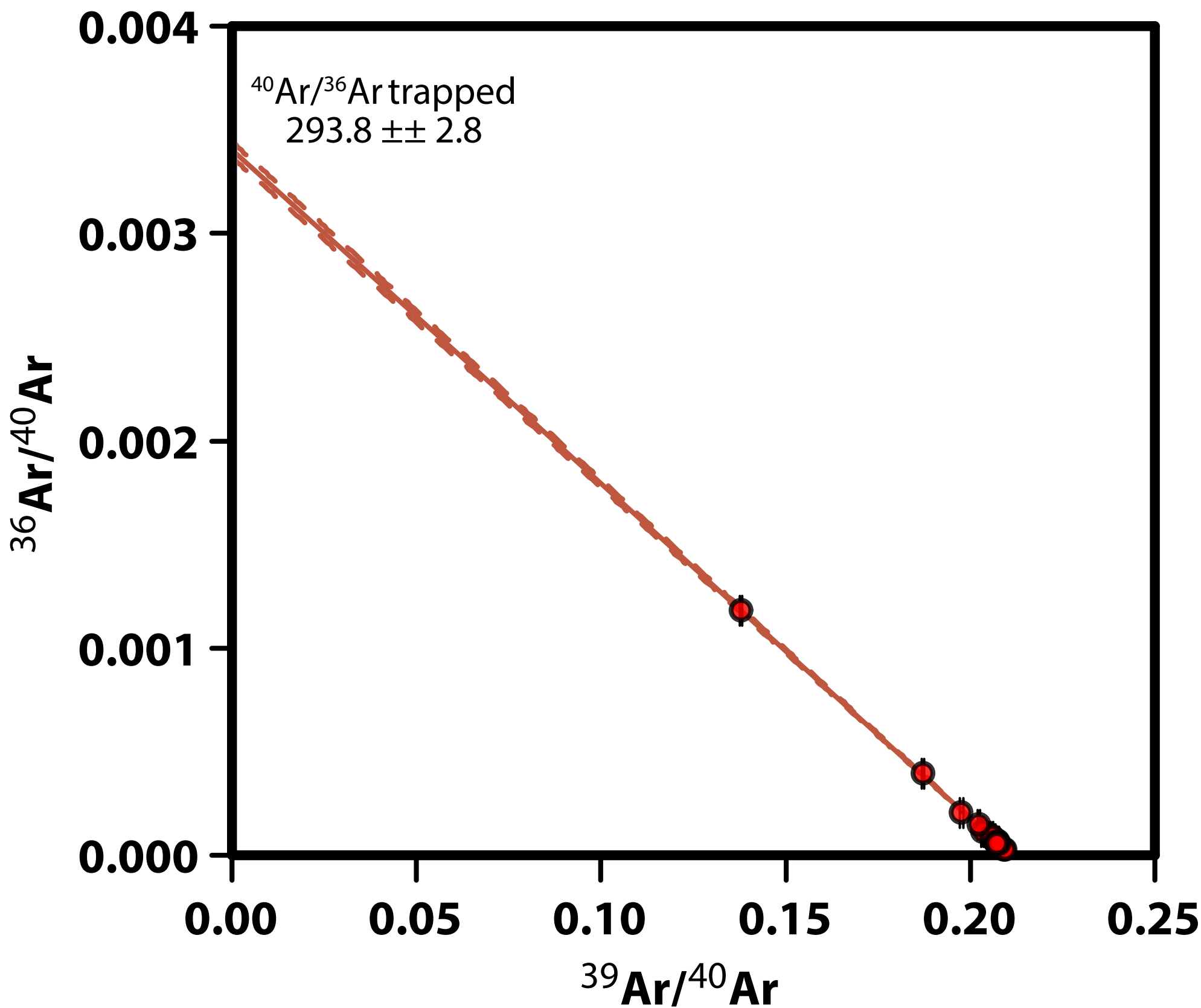
Tuff of Oregon Canyon (TB-429)

$16.450 \pm \pm 0.015$ Ma



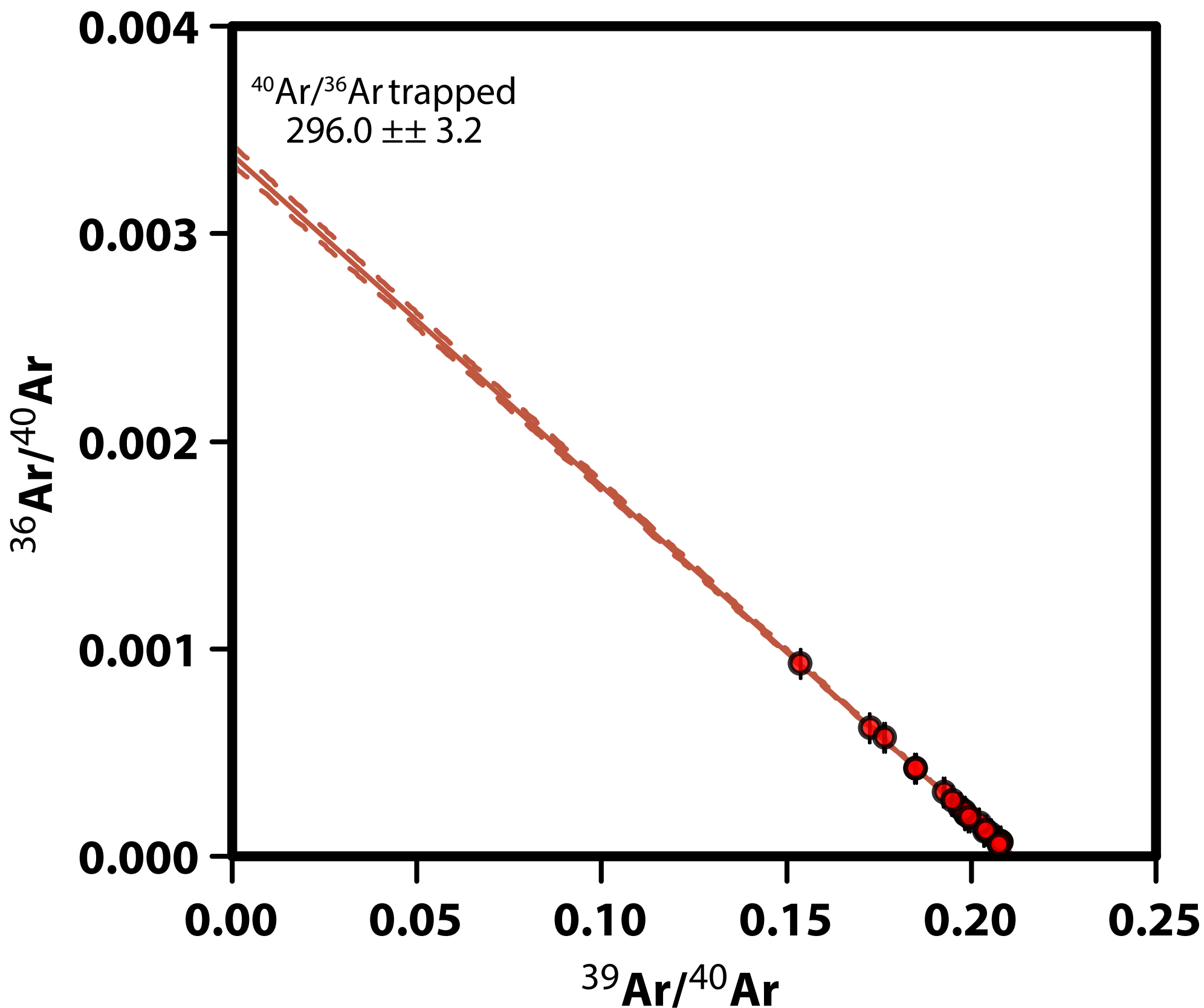
Tuff of Oregon Canyon (TB-433)

$16.468 \pm \pm 0.015$ Ma



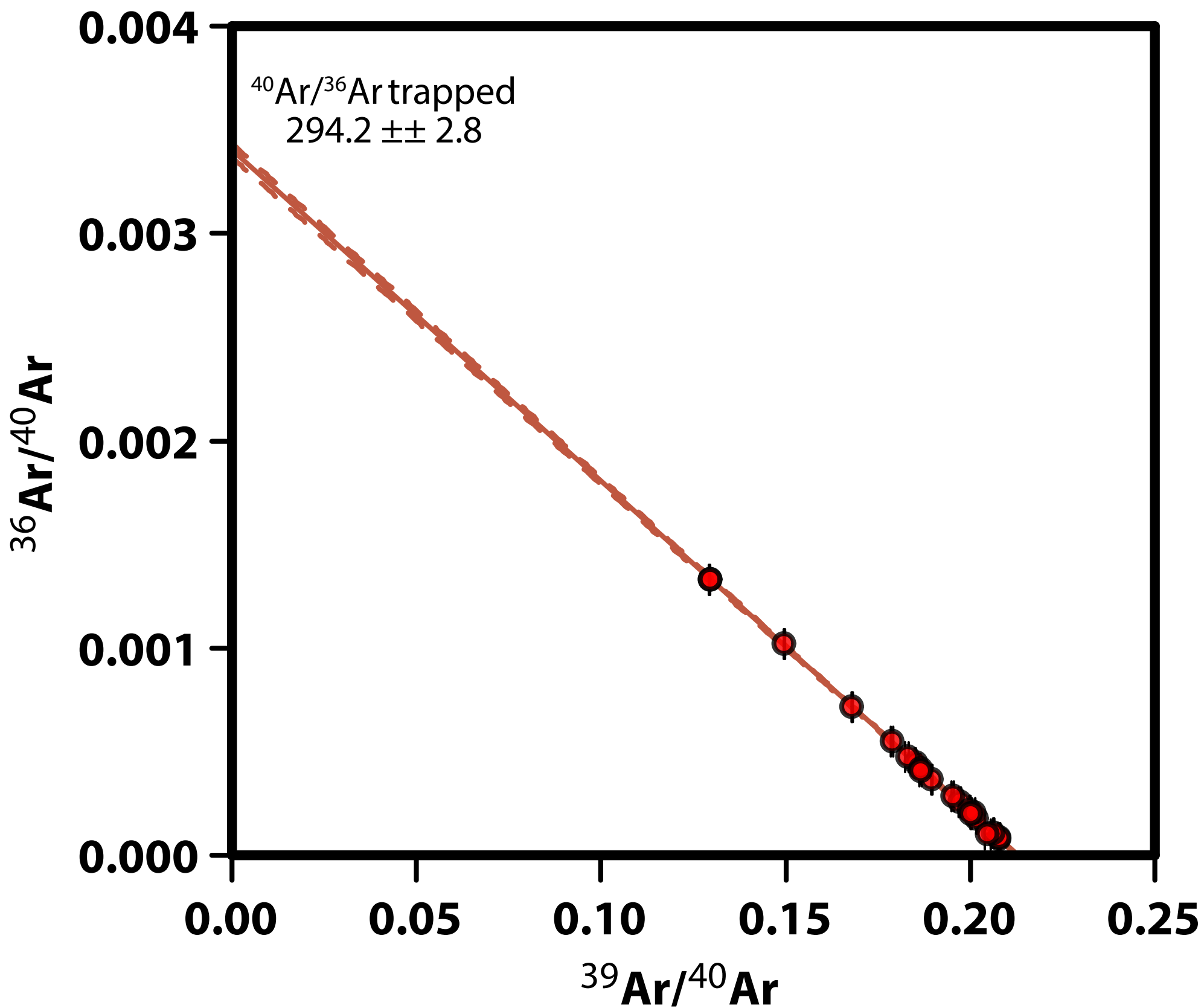
Tuff of Oregon Canyon (TB-435)

$16.457 \pm \pm 0.017$ Ma

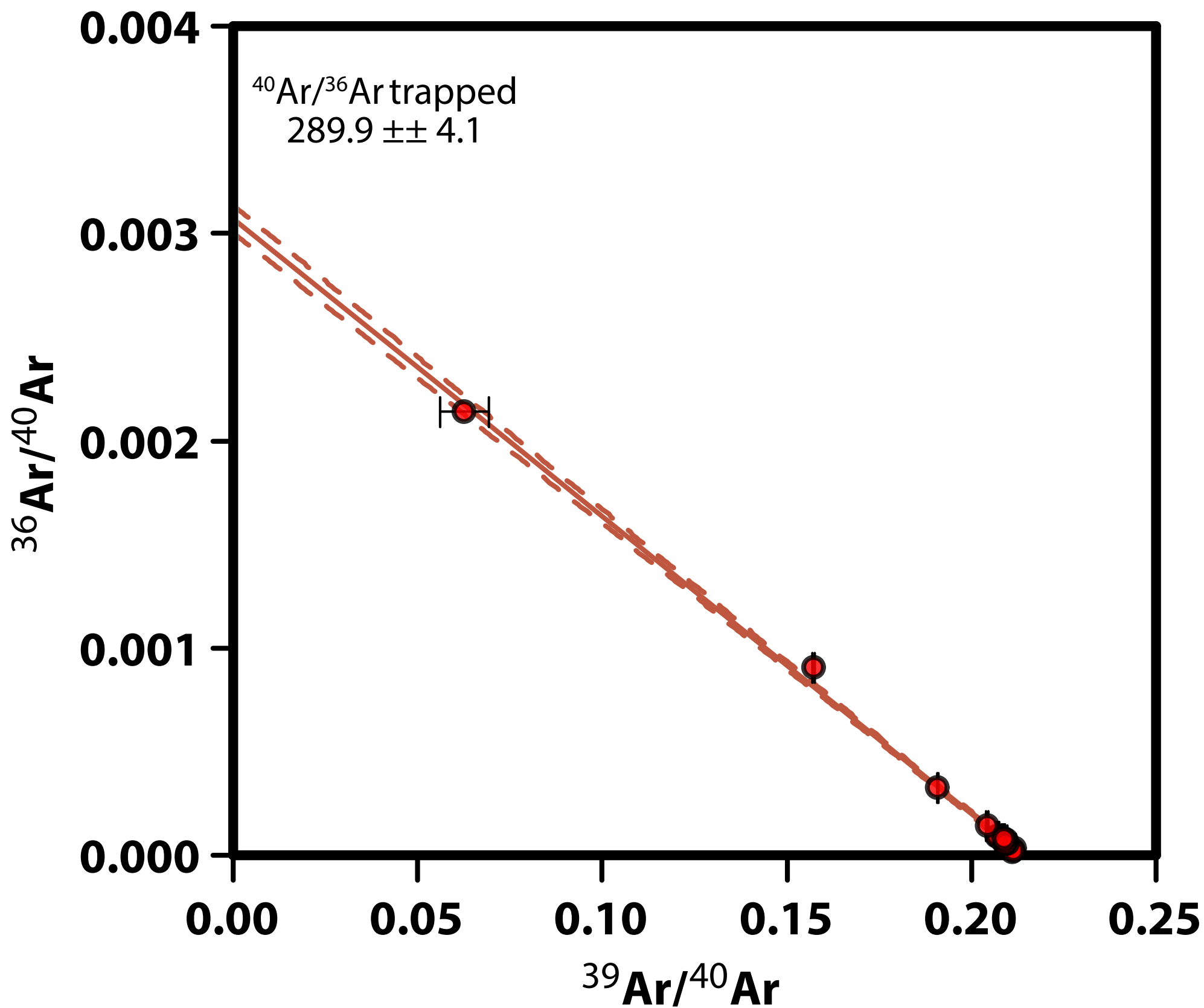


Tuff of Trout Creek Mtns (TB-439)

$16.401 \pm \pm 0.020$ Ma

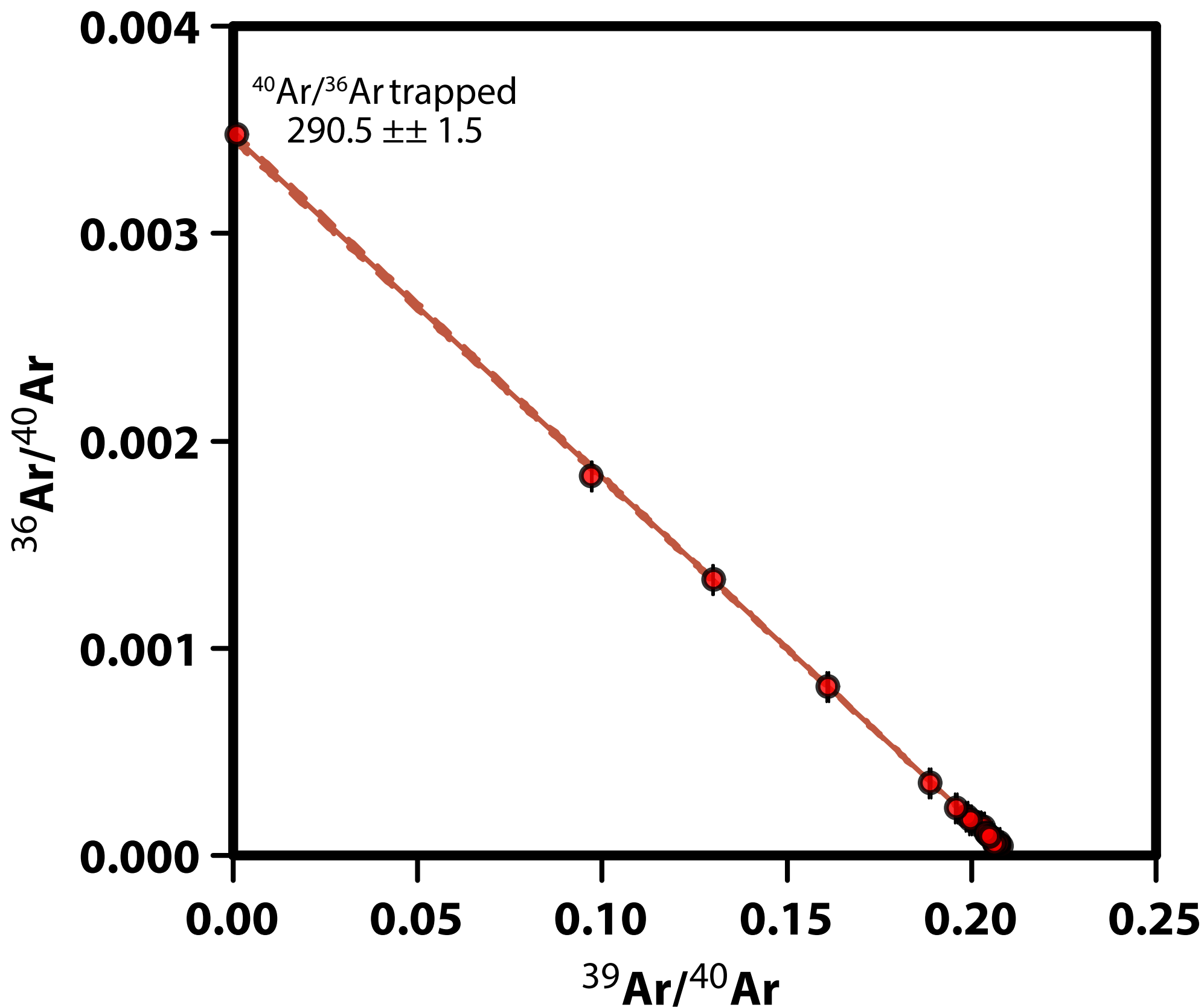


Tuff of Trout Creek Mtns (TB-443)
16.404 \pm 0.015 Ma

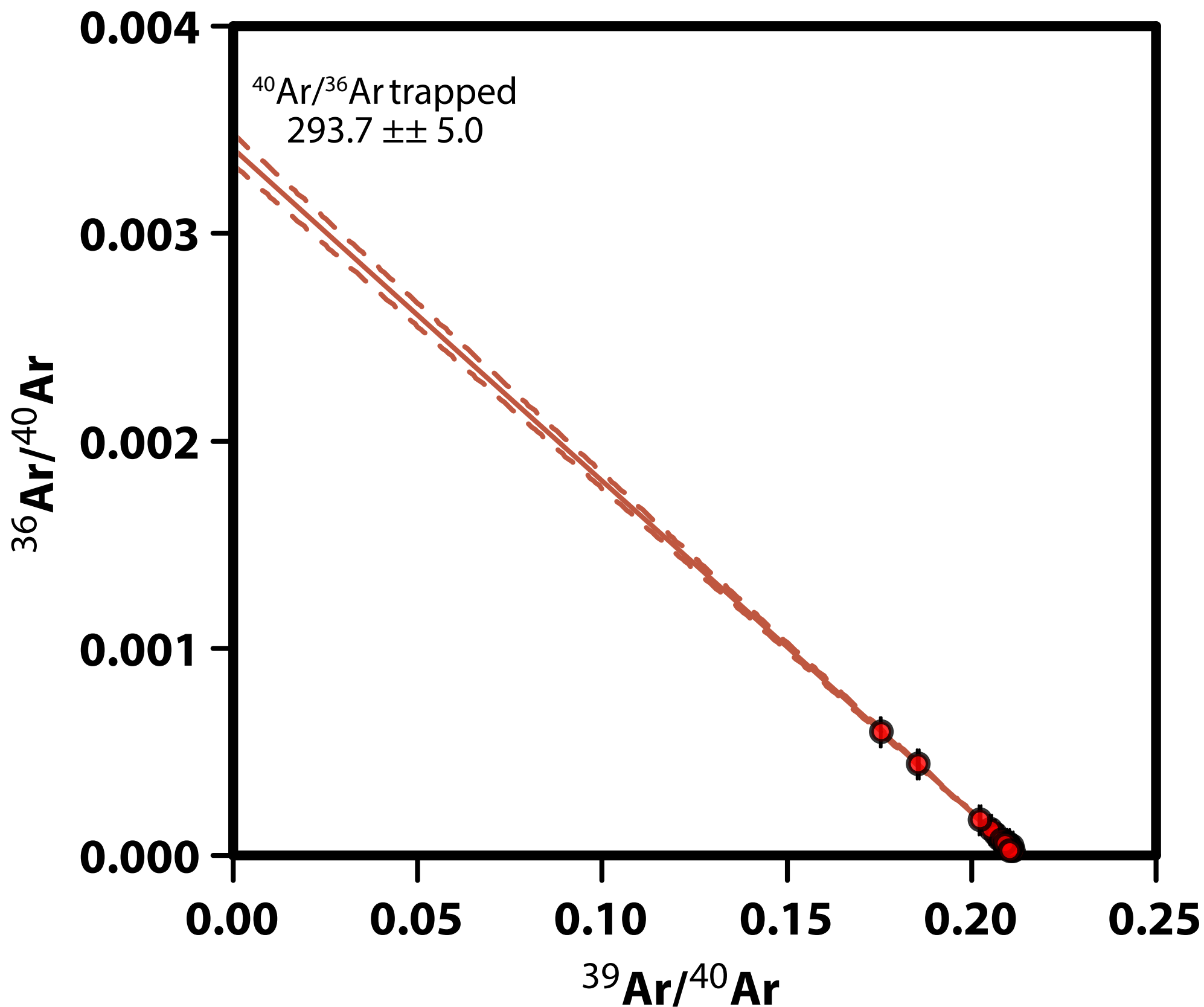


Tuff of Oregon Canyon (TB-444)

$16.461 \pm \pm 0.015$ Ma

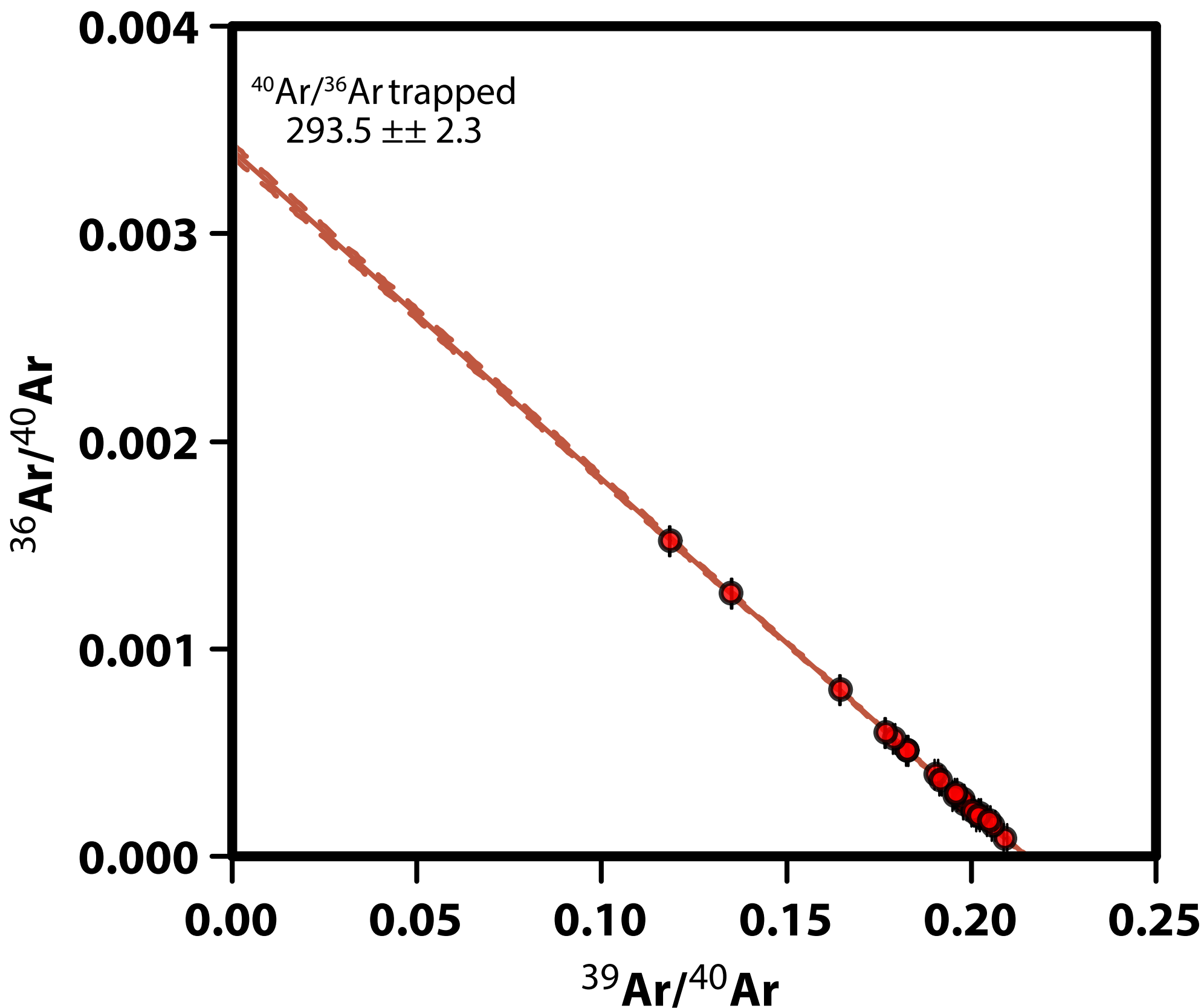


Tuff of Trout Creek Mtns (TB-451)
16.431 \pm 0.015 Ma



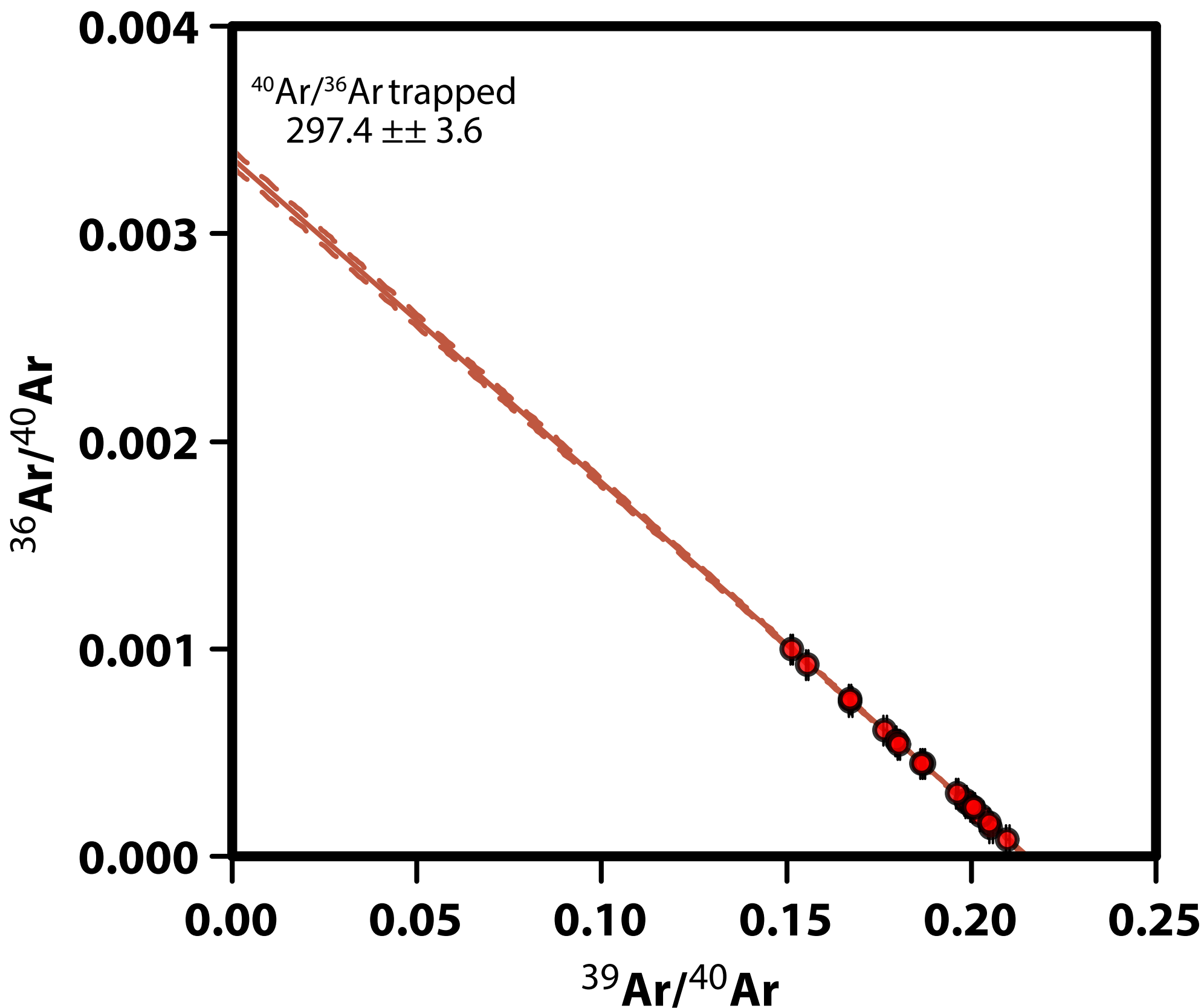
Tuff of Long Ridge (TB-452)

$16.343 \pm \pm 0.026$ Ma

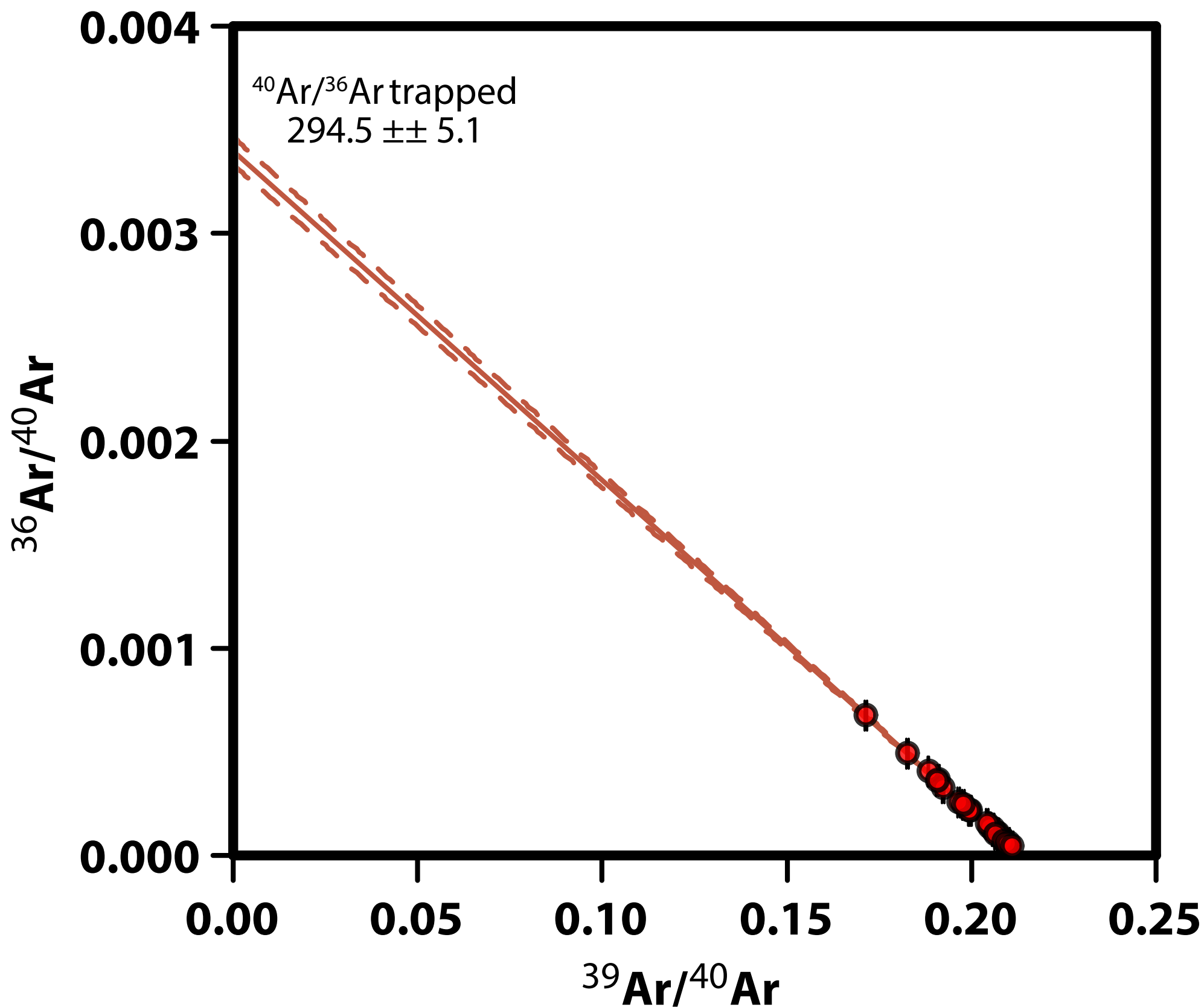


Tuff of Long Ridge (TB-455)

$16.328 \pm \pm 0.031$ Ma

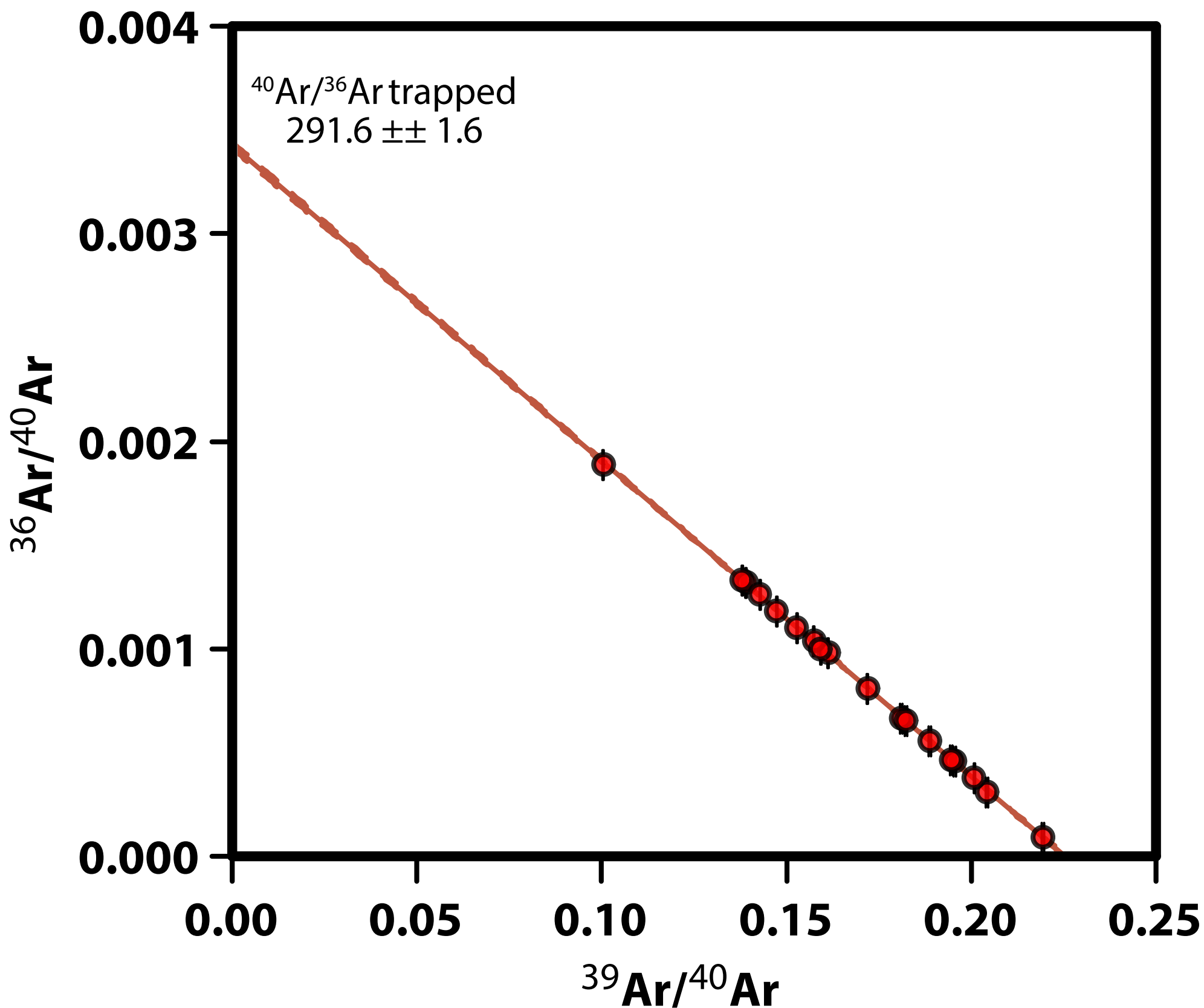


Tuff of Trout Creek Mtns (TB-456)
16.415 \pm 0.020 Ma



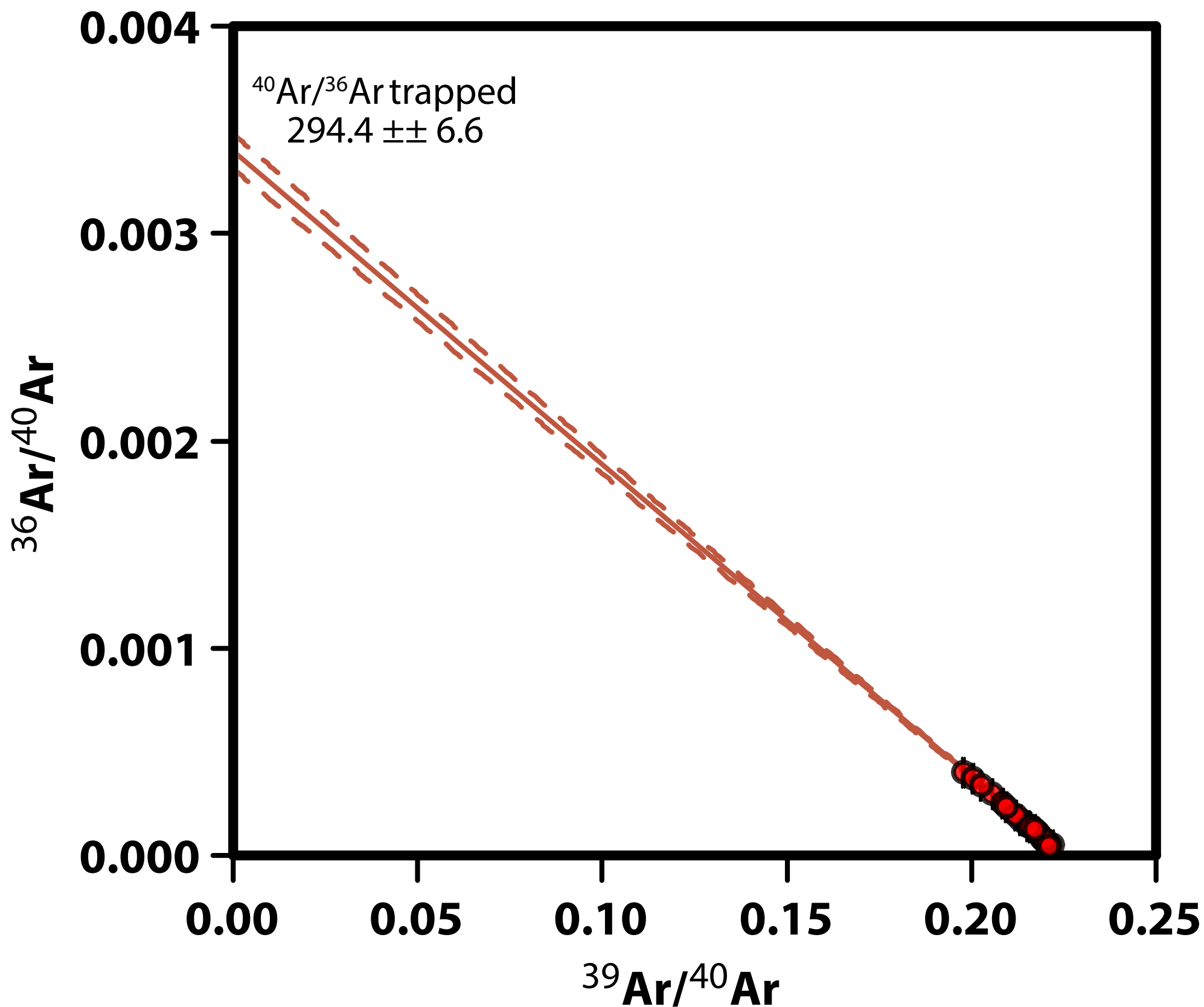
S. Flagstaff Ranch rhyolite lava (TB-468)

$15.544 \pm \pm 0.030$ Ma



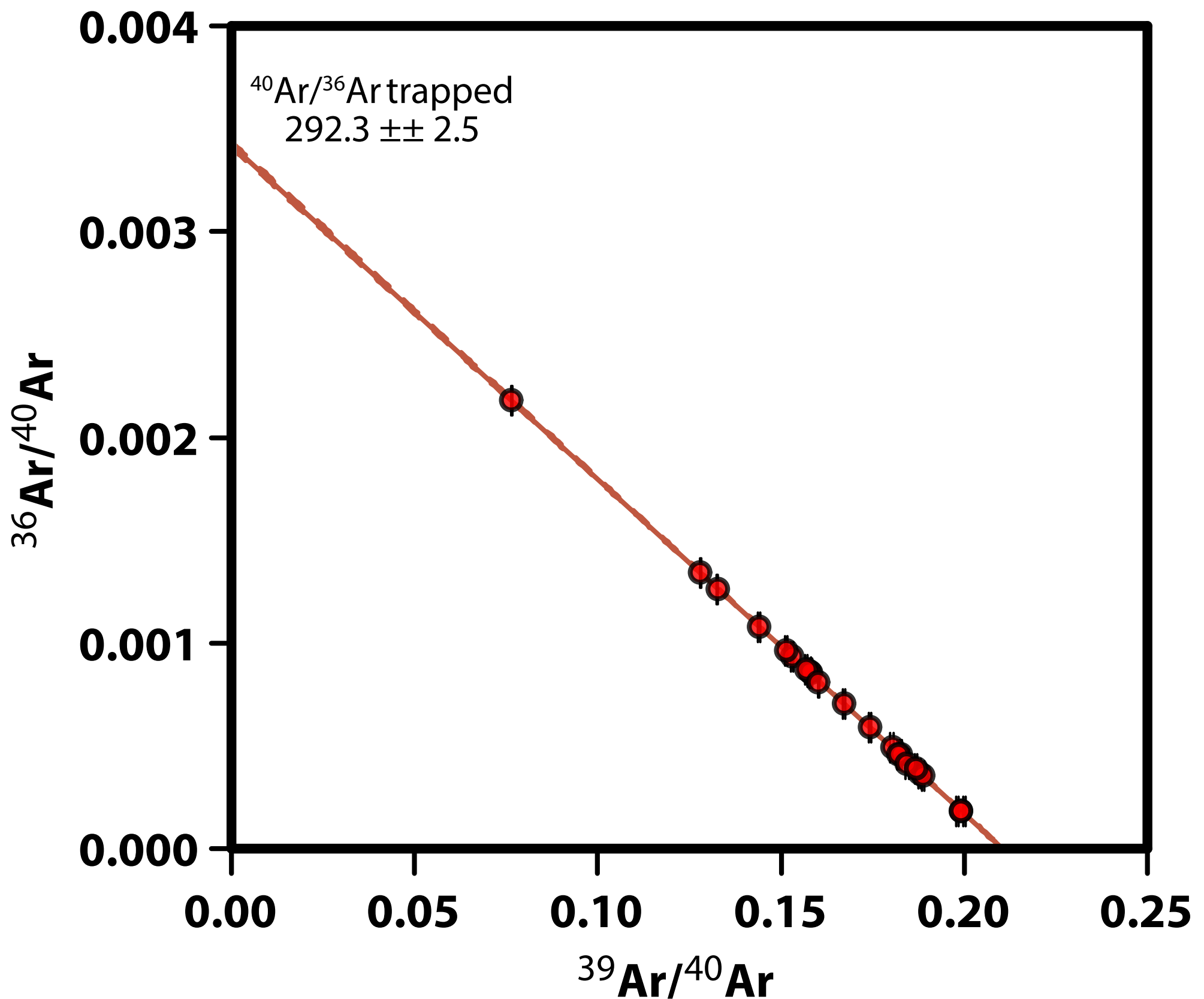
Bearclaw rhyolite lava (TB-469)

$15.555 \pm \pm 0.021$ Ma



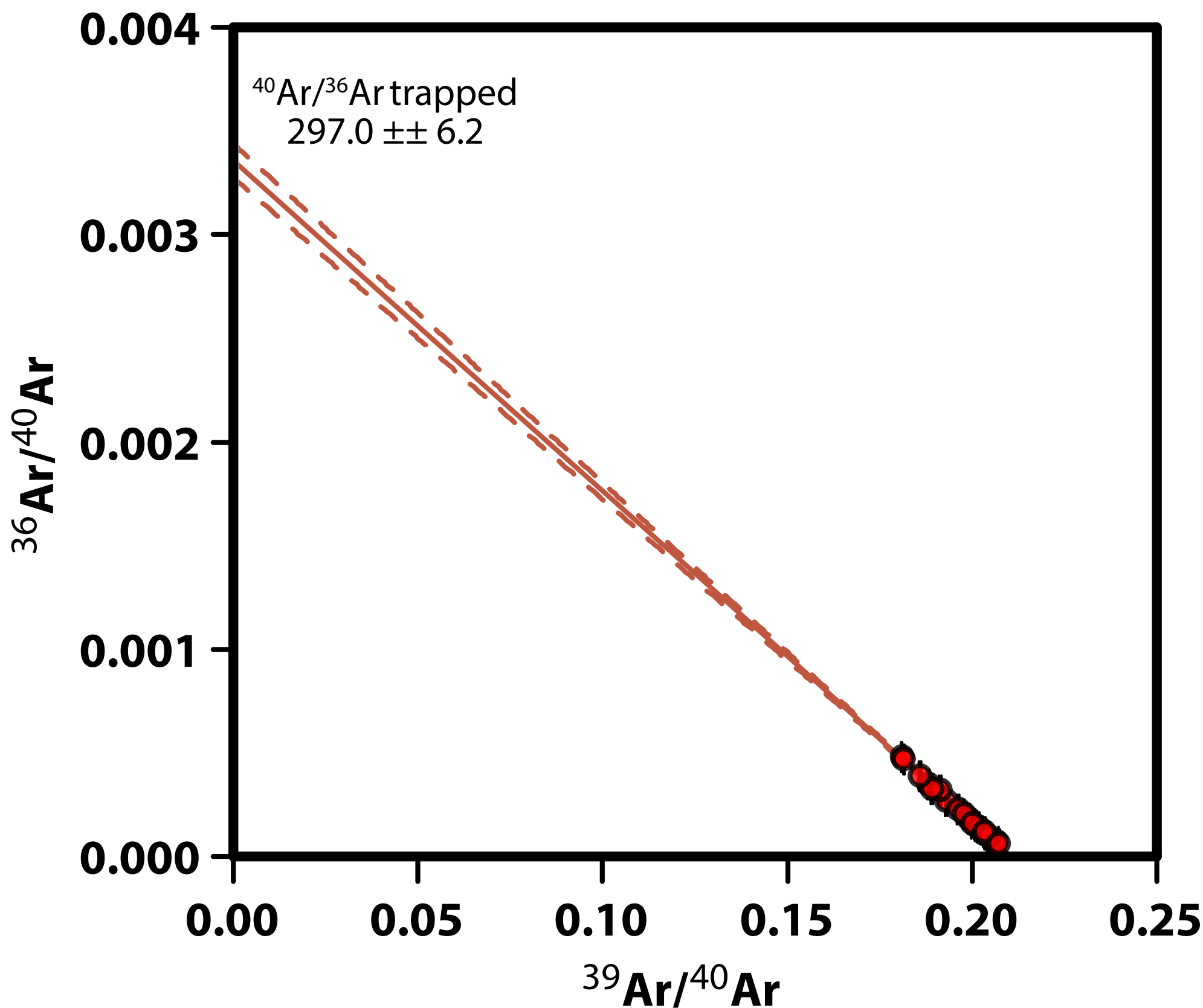
Whitehorse Cyn rhyolite lava (TB-488)

16.511 ± 0.042 Ma

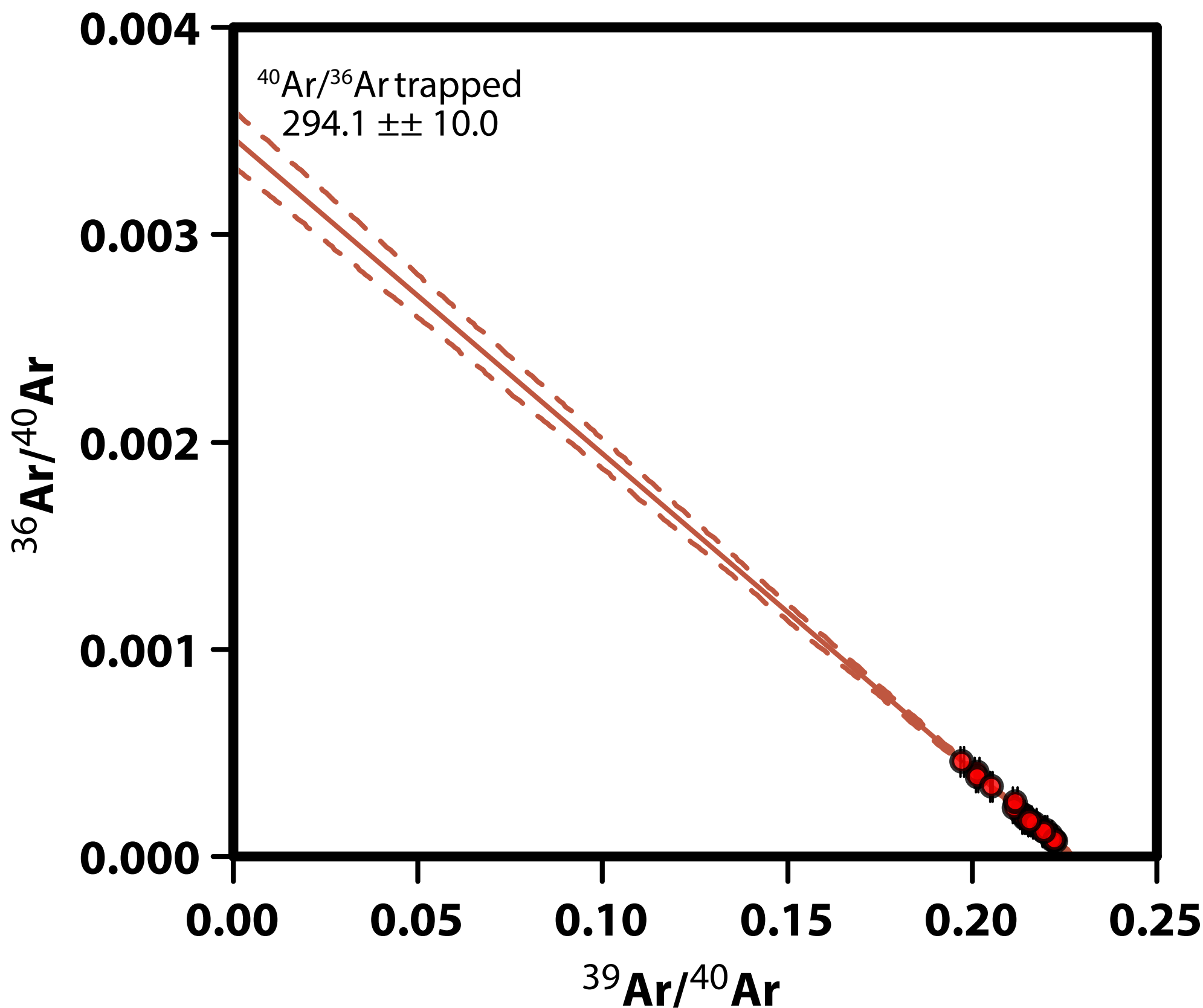


Antelope Creek rhyolite lava (TB-517)

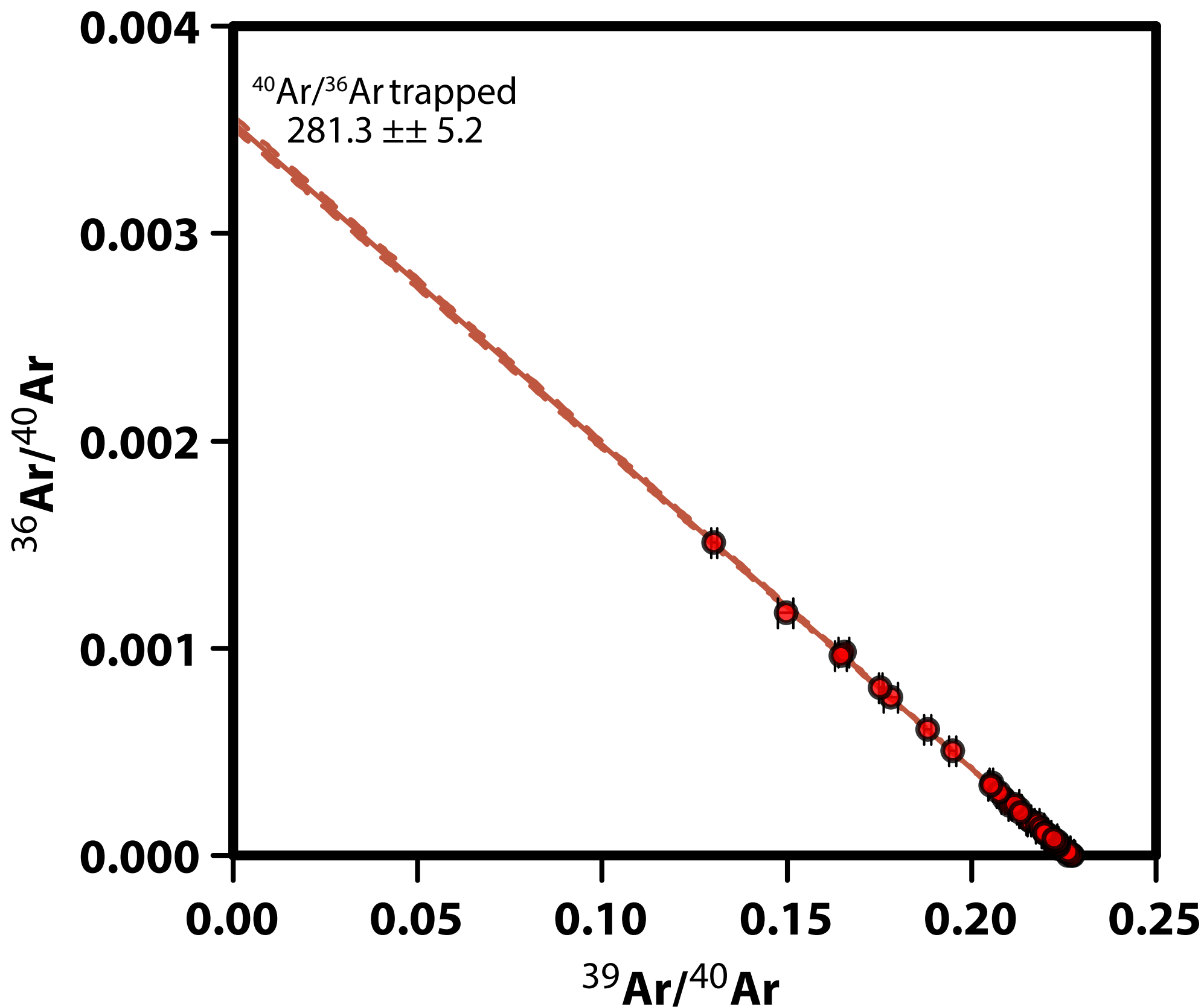
$16.450 \pm \pm 0.028$ Ma



Tuff of Whitehorse Creek (TB-522C)
15.537 \pm 0.032 Ma

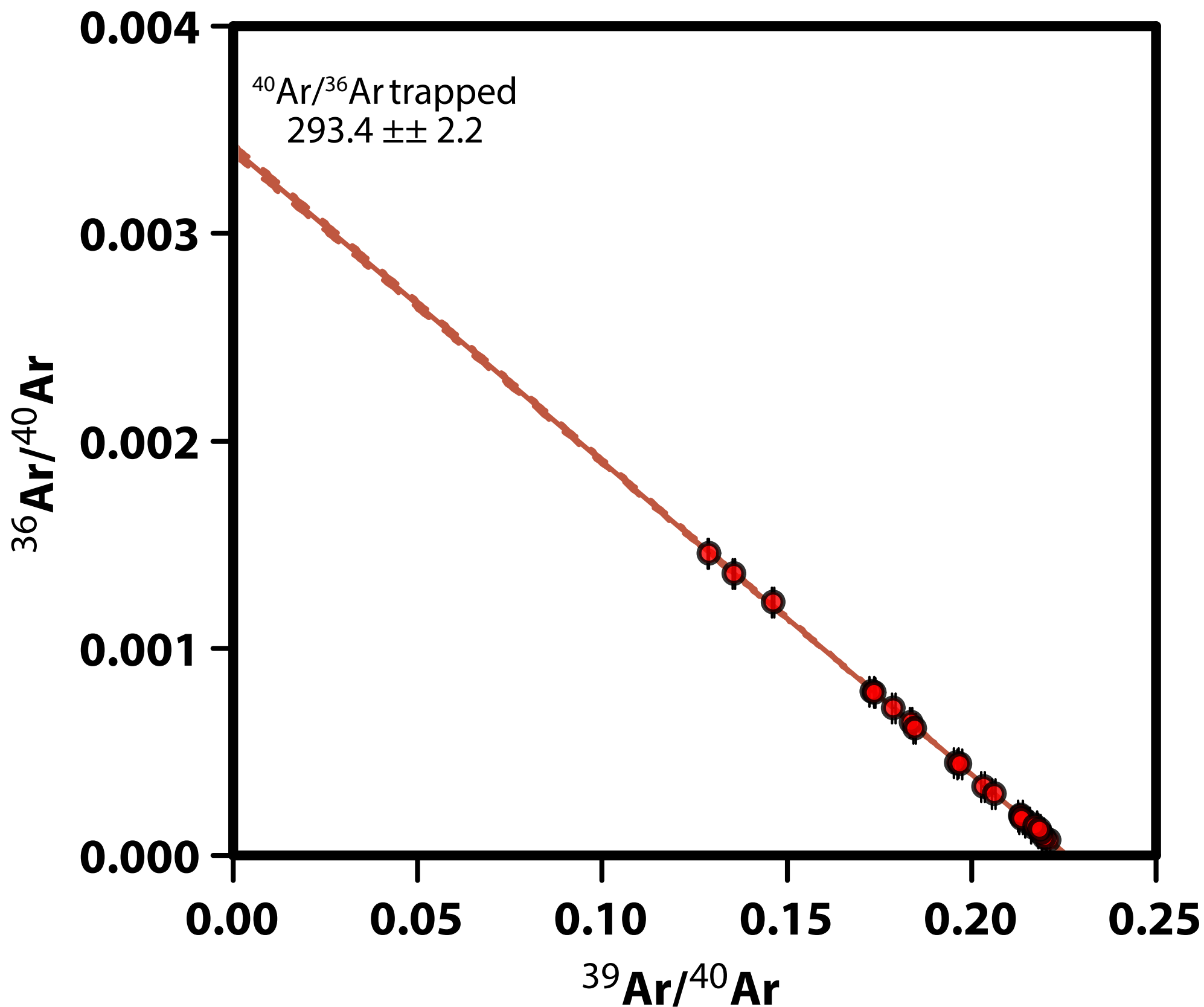


Tuff of Whitehorse Creek (TB-555)
 $15.578 \pm \pm 0.020$ Ma



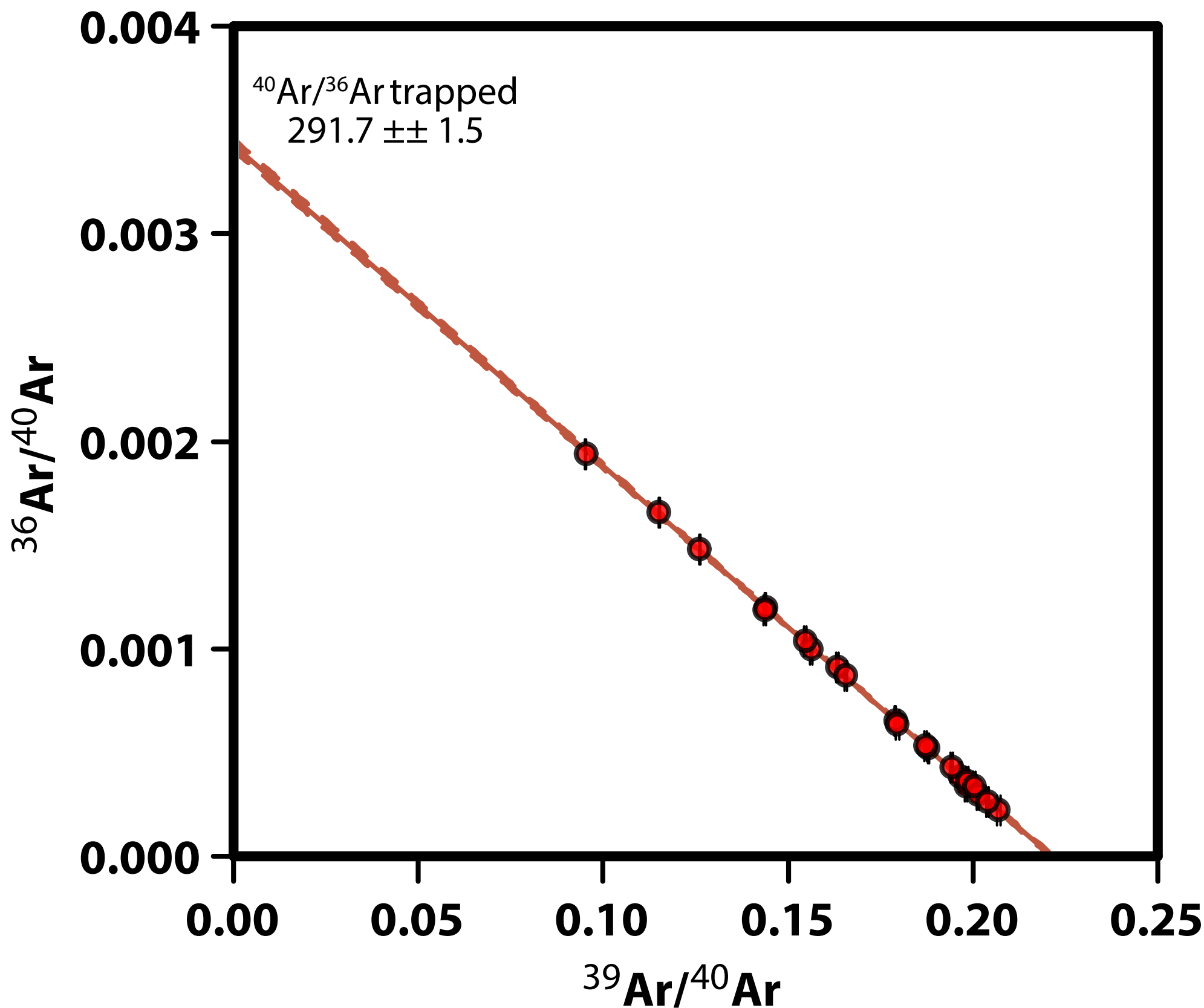
Buckskin Mtn rhyolite lava (TB-558)

$15.526 \pm \pm 0.032$ Ma



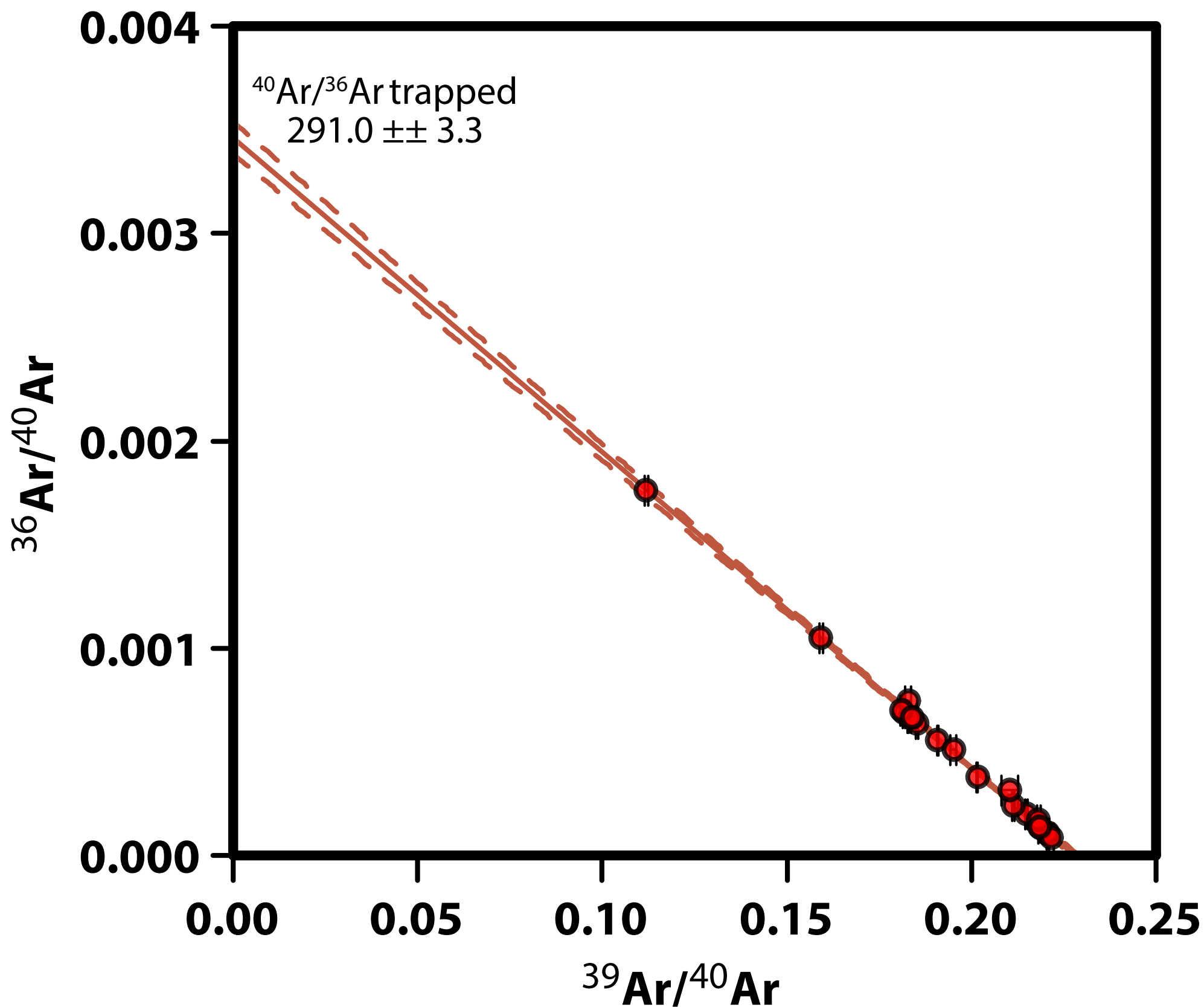
Red Lookout Butte rhyolite lava (TB-563)

$15.589 \pm \pm 0.026$ Ma



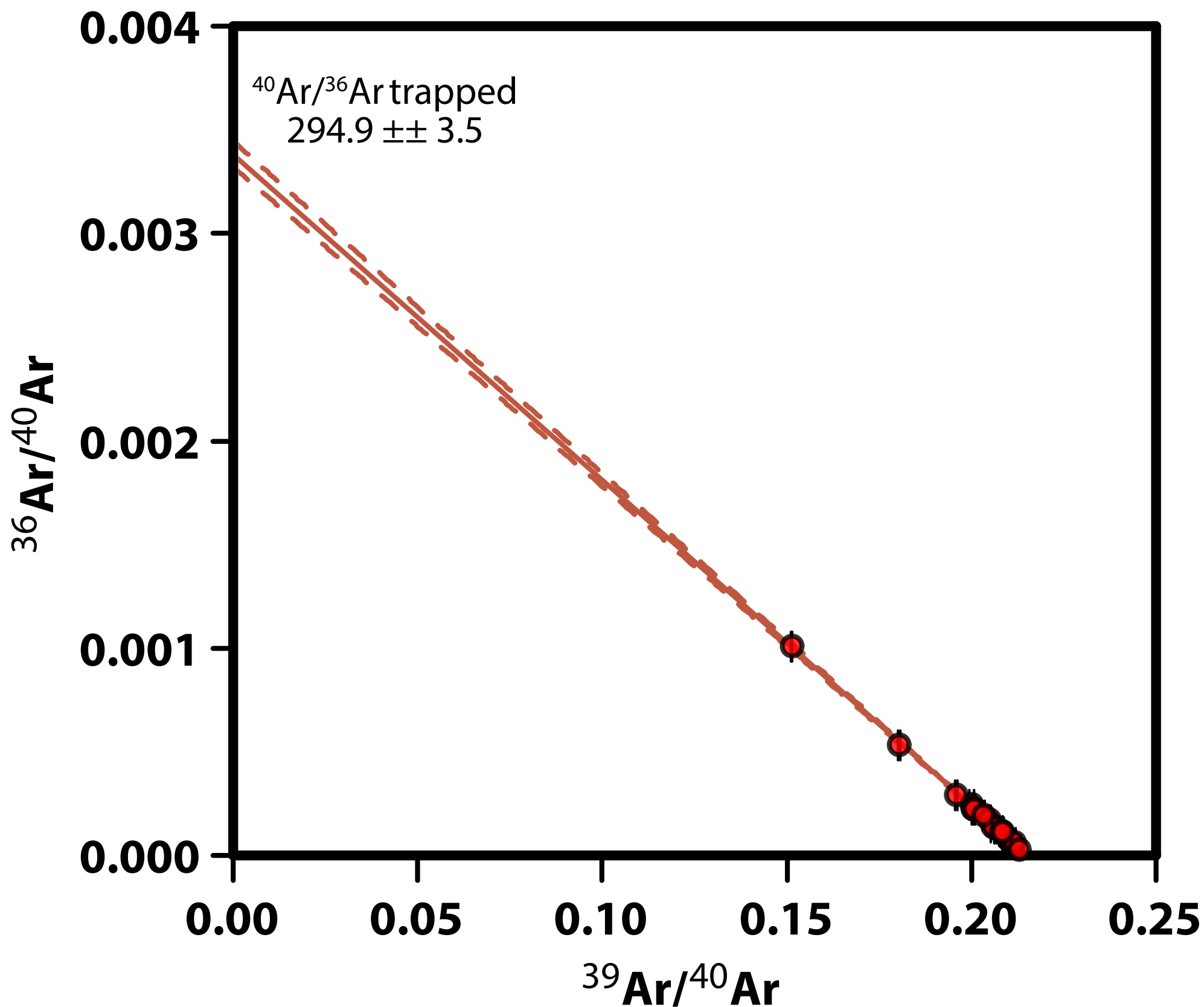
Tuff of Whitehorse Creek (TB-566)

$15.532 \pm \pm 0.026$ Ma



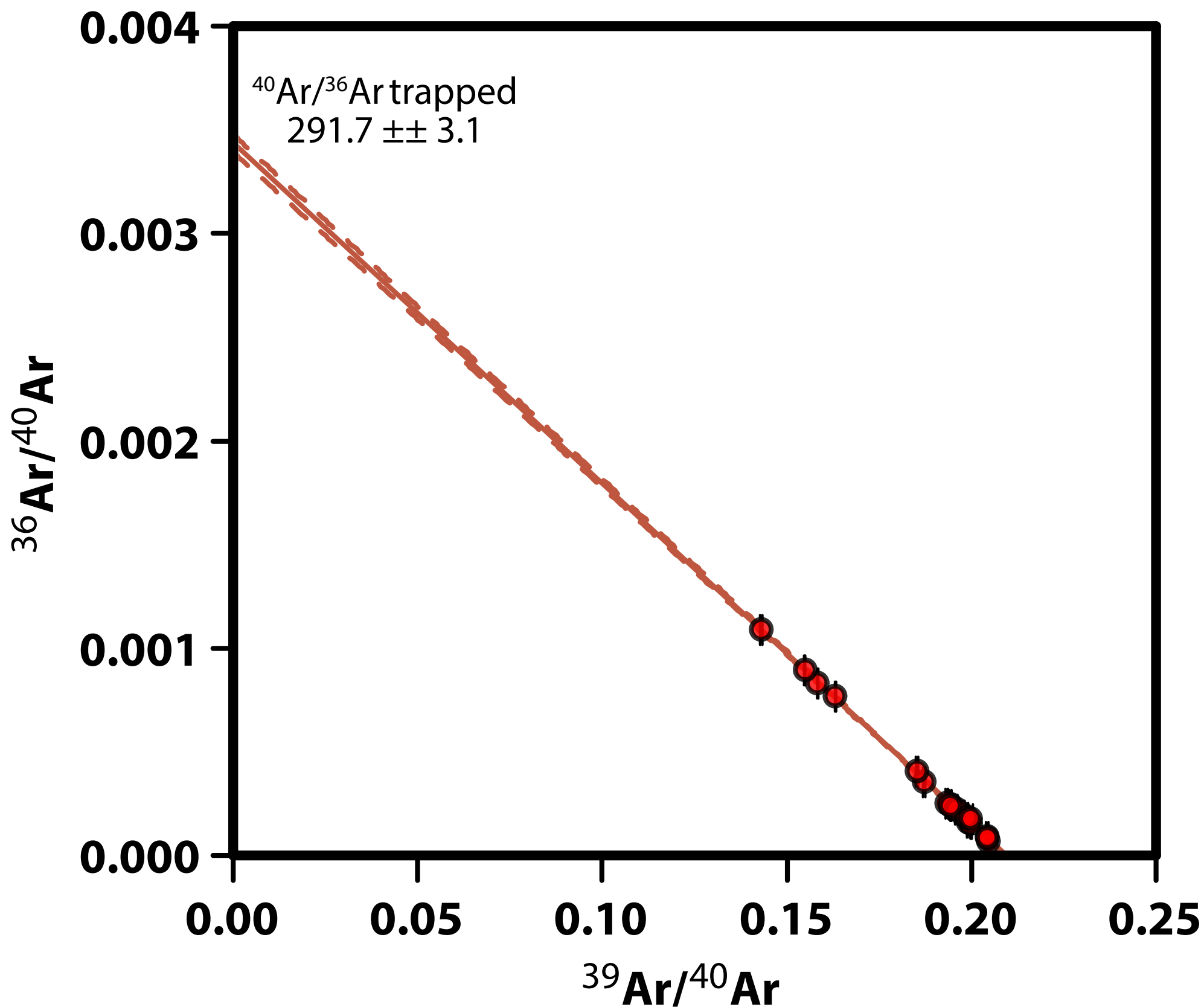
Tule Rims rhyolite lava (TB-567)

$16.122 \pm \pm 0.020$ Ma



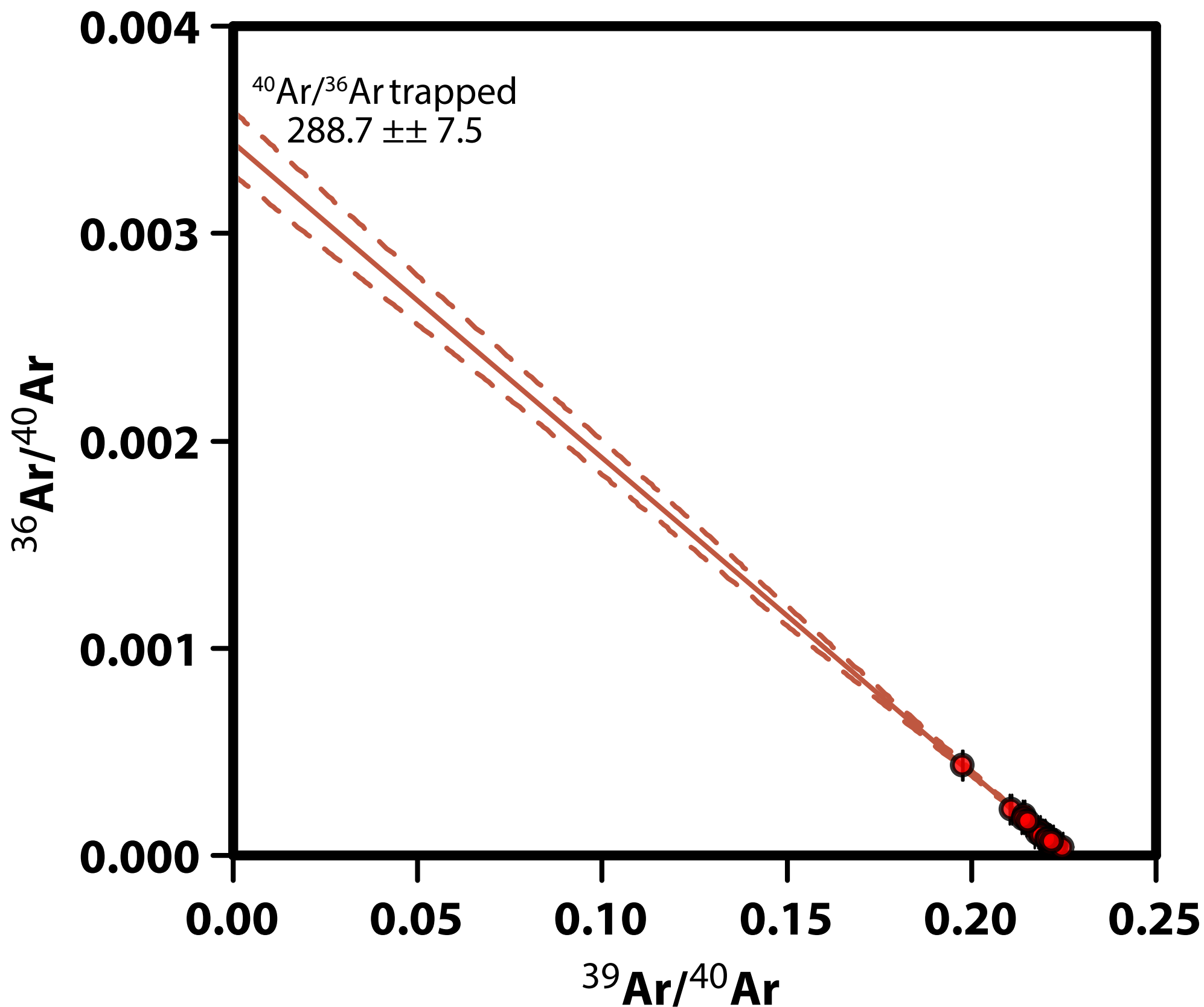
N. Red Mountain rhyolite lava (TB-571)

$16.513 \pm \pm 0.022$ Ma



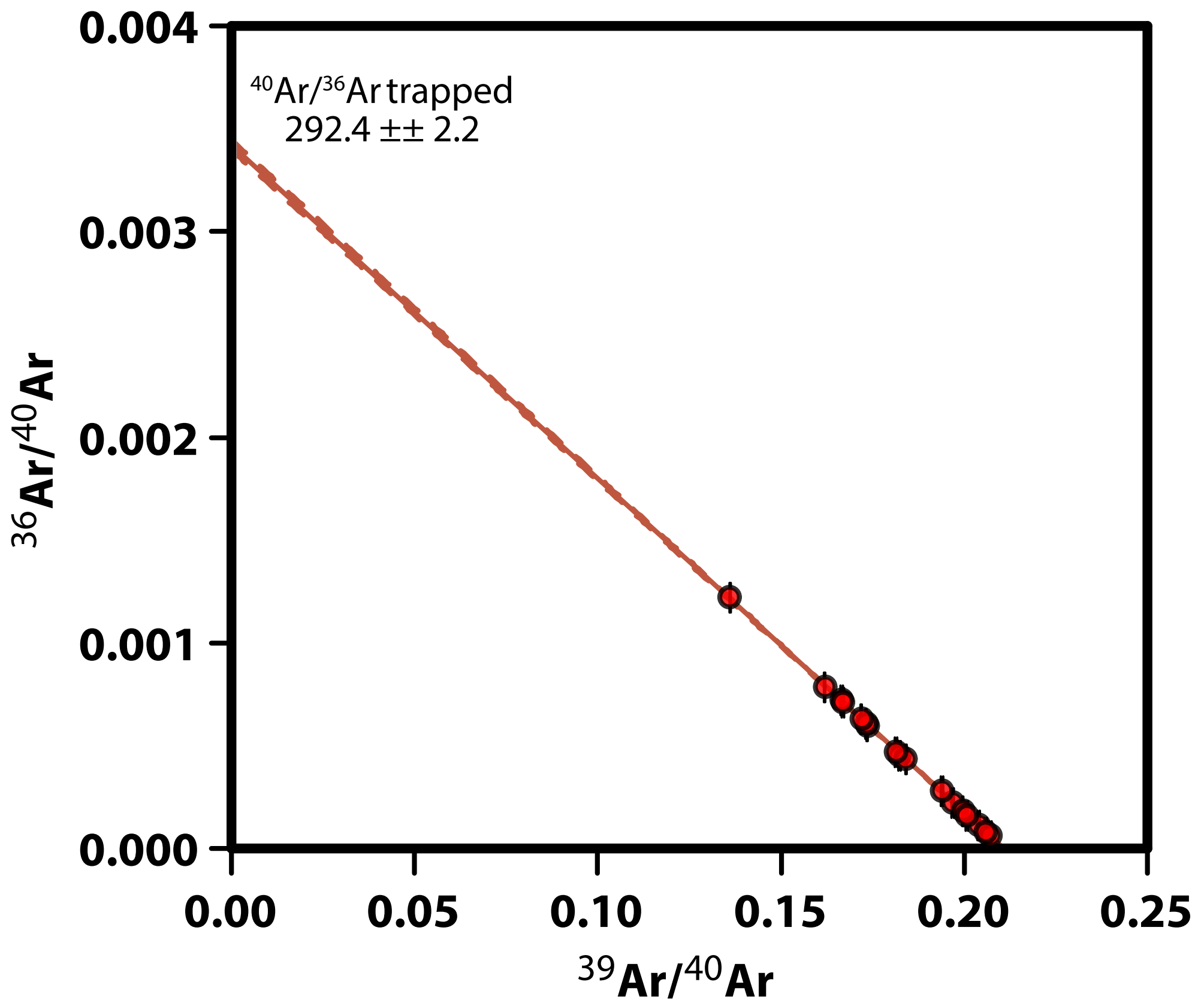
Red Mountain rhyolite lava (TB-573)

$15.446 \pm \pm 0.019$ Ma



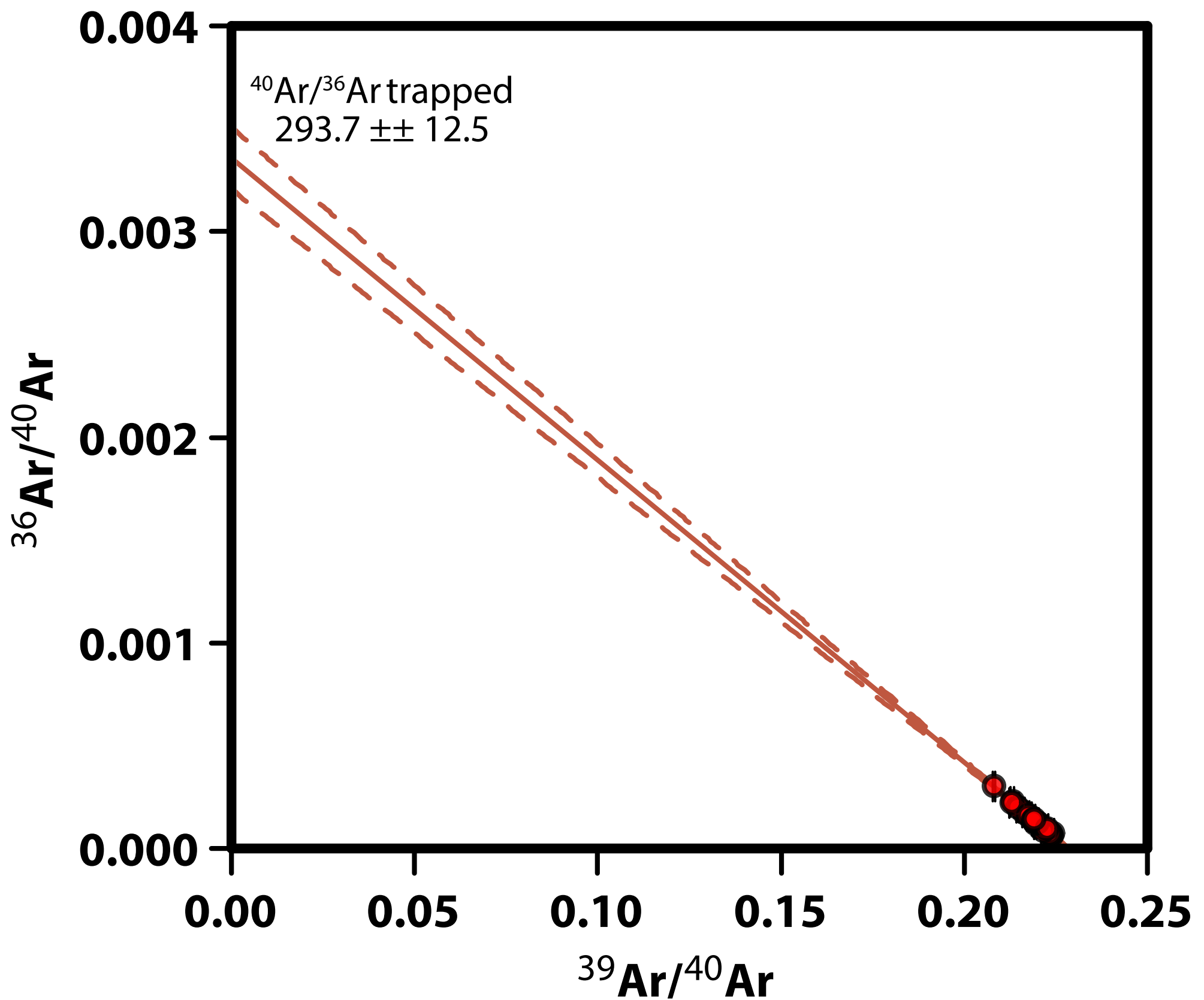
Whitehorse Cyn rhyolite lava (TB-586)

$16.510 \pm \pm 0.022$ Ma



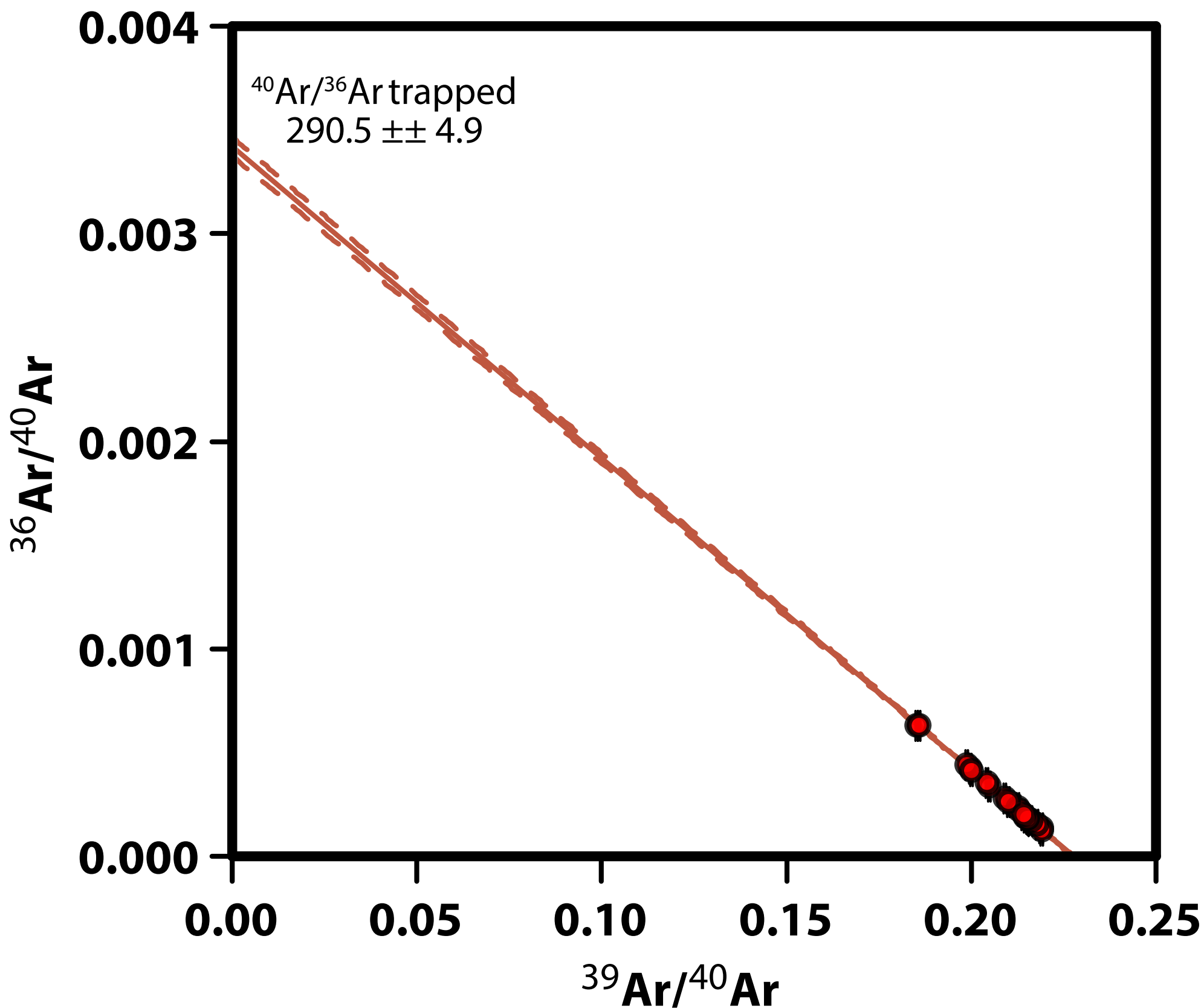
W. Willow Creek rhyolite lava (TB-590)

$15.446 \pm \pm 0.029$ Ma



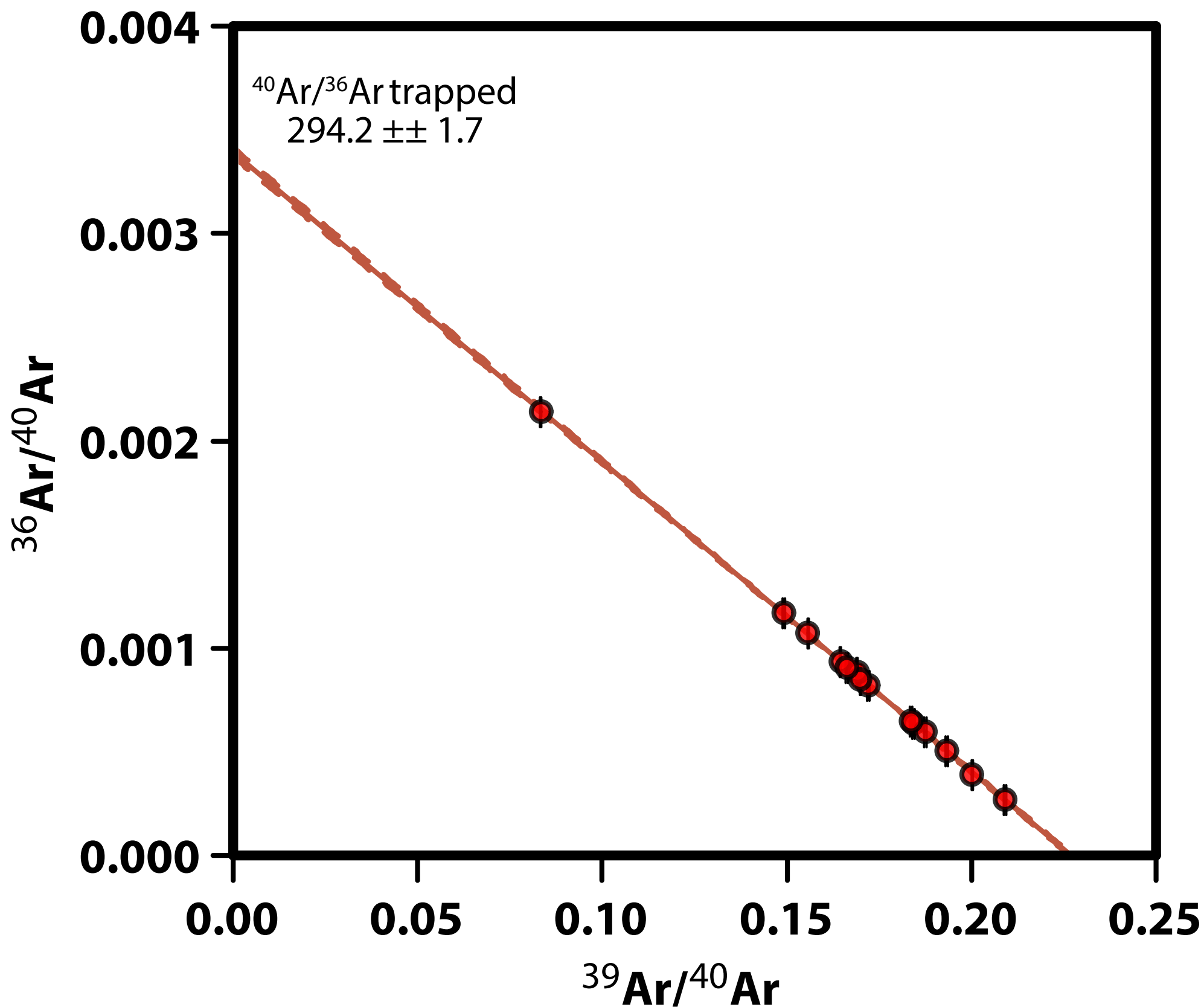
Willow Butte rhyolite lava (TB-593)

$15.464 \pm \pm 0.027$ Ma



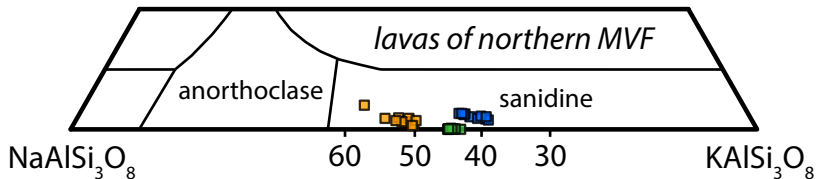
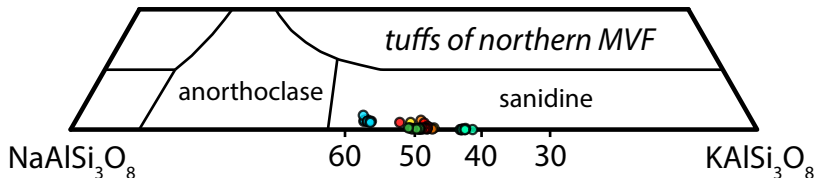
NE campground rhyolite lava (TB-609)

15.553 \pm 0.032 Ma



Appendix E: Feldspar Compositions

- Tioc - Early (TB-429)
- Tioc - Mid (TB-433)
- Tioc - Late (TB-435)
- Titc - Member A (TB-439)
- Titc - Member B (TB-443)
- Tiwc (TB-322)
- Tlwh (TB-317)
- Tlto (TB-354)
- Tloo (TB-355)



Appendix F: Representative normalized whole-rock WD-XRF analyses of volcanic rocks in McDermitt Volcanic Field

	Rhyolite Lavas					Ignimbrites									
Unit	Whitehorse Canyon rhyolite lava	Fish Creek rhyolite lava	Pole Canyon low- silica rhyolite lava	Red Mountain rhyolite lava	Buckskin hornblende rhyolite lava	Tuff of Oregon Canyon			Tuff of Trout Creek Mtns		Tuff of Long Ridge		Tuff of Whitehorse Creek		
Map symbol	Tloo	Tlto	Tlty	Tlwy	Tlwh	Tioc	Tioc	Tioc	Titc	Titc	Tilr	Tilr	Tiwc	Tiwc	
Description	pre-Tio	pre-Tit	post-Tit	post-Tiw	post-Tiw	early	mid	late	Member A	Member B	early	late	outflow	intracaldera	
Sample #	TB-586*	TB-354	TB-333	TB-573	TB-317	TB-429**	TB-433	TB-435	TB-439	TB-443	EW-210	EW-213	TB-322**	W7-466**	
Sample type	SL	DL	DL	DL	DL	MWI	DWI	DWI	DWI	DWI	DWI	RI	NWI	NWI	
Latitude	42.23179	42.28041	42.18819	42.28692	42.26712	42.15851	42.15866	42.15867	42.15867	42.15890	42.34286	42.34311	42.22749	42.20448	
Longitude	-118.14403	-118.18412	-118.37118	-118.31409	-118.38269	-118.45157	-118.45172	-118.45187	-118.45271	-118.45338	-117.88136	-117.88191	-118.23219	-118.33549	
Age (Ma) + 2s err	16.510 ±± 0.022	16.445 ±± 0.022	~16.4	15.446 ±± 0.019	15.369 ±± 0.015	16.450 ±± 0.015	16.468 ±± 0.015	16.457 ±± 0.017	16.401 ±± 0.020	16.404 ±± 0.015	16.305 ±± 0.022	~16.33	15.559 ±± 0.044	~15.56	
SiO2	78.80	76.70	71.69	75.92	77.23	74.92	76.07	72.86	75.13	74.03	71.93	74.34	70.89	72.87	
TiO2	0.16	0.20	0.68	0.07	0.11	0.28	0.16	0.33	0.23	0.33	0.37	0.27	0.26	0.16	
Al2O3	10.70	10.03	13.91	12.57	12.55	11.33	11.10	11.85	9.78	11.47	12.50	11.78	14.67	13.55	
Fe2O3T	2.07	4.42	5.99	1.77	0.95	3.49	2.97	4.48	4.68	4.33	4.61	3.65	3.53	2.67	
MnO	0.04	0.04	0.05	0.04	0.03	0.06	0.08	0.12	0.09	0.08	0.12	0.11	0.11	0.07	
MgO	0.13	0.10	0.20	0.24	0.13	0.34	0.07	0.36	0.15	0.35	0.26	0.10	0.82	0.26	
CaO	0.28	0.19	0.35	0.37	0.34	0.51	0.44	0.66	0.74	0.37	0.65	0.36	1.20	0.49	
Na2O	3.62	3.48	1.31	3.72	3.82	4.20	4.33	4.44	4.49	4.19	4.28	4.24	3.05	3.10	
K2O	4.00	4.51	5.29	5.11	4.65	4.55	4.53	4.64	4.37	4.65	4.98	4.93	5.21	6.63	
P2O5	0.04	0.08	0.16	0.05	0.05	0.09	0.04	0.08	0.08	0.05	0.11	0.04	0.07	0.03	
Trace Elements	<u>0.16</u>	<u>0.24</u>	<u>0.37</u>	<u>0.14</u>	<u>0.13</u>	<u>0.23</u>	<u>0.21</u>	<u>0.19</u>	<u>0.25</u>	<u>0.14</u>	<u>0.19</u>	<u>0.17</u>	<u>0.20</u>	<u>0.17</u>	
TOTAL (with Fe2O3T, TE, no LOI)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
LOI	1.53	0.96	3.35	1.14	0.70	2.35	0.61	1.71	1.34	1.81	1.24	0.62	7.38	5.30	
Agpaite Index: (Na+K)/Al	0.96	1.06	0.57	0.93	0.90	1.04	1.08	1.04	1.24	1.04	0.99	1.05	0.73	0.74	
Rb	143	151	153	275	260	170	199	136	174	92	150	180	204	227	
Sr	11	16	41	16	71	46	11	23	33	28	36	15	79	18	
Y	77	175	72	38	44	151	100	91	126	66	81	75	79	73	
Zr	522	782	416	374	194	666	729	482	757	346	373	441	562	531	
V	9	26	19	6	6	13	7	13	9	16	19	7	23	5	
Ni	4	3	1	5	2	3	2	2	4	2	3	3	5	2	
Cr	17	11	15	14	12	18	9	15	12	13	14	11	13	15	
Nb	30	33	19	48	39	33	36	30	36	18	22	26	40	37	
Ga	25	34	26	27	23	29	32	30	34	31	27	30	30	28	
Cu	10	11	8	13	9	10	8	7	8	12	12	7	15	10	
Zn	87	172	167	69	17	200	164	185	271	139	144	152	114	106	
Co	nd	1	2	nd	nd	nd	nd	1	nd	1	nd	nd	1	nd	
Ba	117	144	2004	54	239	180	99	290	248	224	530	248	174	110	
La	60	77	40	38	52	73	78	54	69	46	50	54	62	59	
Ce	107	150	84	67	82	126	125	111	143	72	81	102	119	108	
U	5	nd	0	5	6	4	nd	nd	2	1	6	2	4	4	
Th	33	40	22	50	50	36	39	32	39	23	29	32	36	32	
Sc	nd	nd	11	nd	nd	nd	nd	3	nd	nd	1	nd	nd	nd	
Pb	21	33	24	20	20	38	28	23	31	15	15	20	13	29	

SL = silicified lava; DL = devitrified lava; NWI = non-welded ignimbrite; MWI = moderately welded ignimbrite; DWI = densely welded ignimbrite

* silicified sample; SiO2 concentration too high

**samples that likely lost alkalis on alteration

Sample #	TB-435			TB-443			EW-210			TB-322		
	WD-XRF	ED-XRF	% difference	WD-XRF	ED-XRF	% difference	WD-XRF	ED-XRF	% difference	WD-XRF	ED-XRF	% difference
TiO2 (wt %)	0.33	0.38	0.15	0.33	0.37	0.13	0.37	0.36	-0.03	0.26	0.26	0.00
Fe2O3T (wt %)	4.48	4.38	-0.02	4.33	4.18	-0.04	4.61	4.41	-0.04	3.53	3.28	-0.07
MnO (wt. %)	0.12	0.11	-0.08	0.08	0.07	-0.12	0.12	0.15	0.25	0.11	0.07	-0.36
CaO (wt. %)	0.66	0.52	-0.21	0.37	0.37	0.00	0.65	0.39	-0.40	1.20	1.25	0.04
Rb (ppm)	136	150	0.10	92	100	0.08	150	163	0.08	204	194	-0.05
Sr (ppm)	23	19	-0.19	28	22	-0.20	36	28	-0.21	79	68	-0.13
Y (ppm)	91	58	-0.36	66	44	-0.33	81	36	-0.56	79	54	-0.32
Zr (ppm)	482	429	-0.11	346	339	-0.02	373	363	-0.03	562	547	-0.03
Nb (ppm)	30	27	-0.10	18	19	0.07	22	21	-0.08	40	40	-0.01
Ga (ppm)	30	26	-0.11	31	26	-0.14	27	24	-0.11	30	25	-0.16
Cu (ppm)	7	8	0.17	12	9	-0.24	12	11	-0.10	15	14	-0.09
Zn (ppm)	185	189	0.02	139	133	-0.04	144	120	-0.17	114	111	-0.03
Ba (ppm)	290	267	-0.08	224	208	-0.07	530	739	0.40	174	103	-0.41
La (ppm)	54	52	-0.04	46	32	-0.30	50	36	-0.28	62	49	-0.21
Ce (ppm)	111	116	0.05	72	71	-0.02	81	100	0.24	119	114	-0.04
Th (ppm)	32	15	-0.54	23	10	-0.59	29	18	-0.39	36	19	-0.48
U (ppm)	nd	4	na	1	3	1.46	6	7	0.14	4	4	-0.03

Appendix H: Mafic EDXRF Data

			P2O5	K2O	CaO	TiO2	V	Cr	FeO*	Ni	Cu	Zn	Sr	Y	Zr	Nb	Ba	Ce
Latitude	Longitude		(wt. %)	(wt. %)	(wt. %)	(wt. %)	(ppm)	(ppm)	(wt. %)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
<i>Steens Basalt - Oregon Canyon Mountains (Tbs)</i>																		
TB-446	42.26024	-118.00708	0.48	2.42	6.86	2.18	287		8.50	32	28	117	507	41	197	13	1,642	61
TB-447	42.25876	-118.00734	0.46	2.05	6.60	2.35	430	2	12.45	47	70	125	495	39	183	12	931	57
TB-448	42.25782	-118.00902	0.31	0.93	9.79	2.08	324	61	9.84	58	86	99	428	34	167	14	361	30
ML-221	42.26250	-118.00348	0.28	0.72	9.84	2.39	354	62	10.59	56	96	107	432	36	164	14	399	47
MW-110	42.26068	-118.00259	0.46	1.59	7.21	2.97	349	23	12.46	39	77	137	354	53	262	20	857	66
<i>Trachyandesite and Trachyte lavas - Oregon Canyon Mountains (Tt)</i>																		
TB-356	42.23918	-118.15802	0.73	3.71	3.89	1.46	70	5	8.16	24	22	131	291	55	288	20	1,769	82
TB-449	42.25781	-118.00923	0.11	4.87	1.72	0.75		3	3.60	19	9	88	181	55	296	17	1,733	84
TB-450	42.25587	-118.01427	0.43	2.97	5.23	2.41	277		10.89	25	20	139	336	52	267	20	1,240	89
TB-491	42.23842	-118.12688	0.12	5.11	1.38	0.55		2	3.23	20	13	91	119	60	355	19	1,743	98
TB-579	42.33645	-118.14164	1.41	2.82	5.45	2.22	194		8.62	30	23	133	386	56	276	20	1,811	90
TB-585	42.22218	-118.14249	0.70	3.41	4.09	1.39	73	5	8.65	24	25	151	303	56	281	21	1,830	85
TB-610	42.43547	-117.82705	0.27	3.61	2.62	0.77		1	5.55	21	13	115	203	62	320	23	1,163	115
EW-200	42.33189	-117.87966	0.21	3.91	3.33	1.11	10	4	8.38	25	32	136	174	55	313	21	1,549	85
ML-204	42.30561	-117.85941	0.05	5.86	1.56	0.49	1	2	4.89	20	11	139	18	57	333	24	481	93
ML-210	42.34215	-117.96302	0.21	3.80	3.87	1.09	14	3	7.25	25	30	136	195	57	321	22	1,546	86
ML-222	42.29997	-117.85814	0.63	3.30	4.56	1.72	185	3	9.18	26	47	126	261	63	382	25	1,006	96
ML-223	42.30775	-117.86127	0.11	6.04	1.58	0.49		3	5.31	21	14	134	20	56	326	23	526	87
ML-224	42.30970	-117.86832	0.29	4.34	1.75	0.81	7	5	6.86	24	27	124	130	62	332	22	1,093	87
ML-225	42.30889	-117.86700	0.37	4.39	3.14	0.93		6	8.03	25	26	133	152	51	291	20	1,677	79
ML-226	42.30889	-117.86700	0.95	3.42	3.48	1.37	42	7	9.24	26	29	119	306	53	292	20	2,122	77
ML-227	42.31396	-117.87068	0.16	5.51	1.96	0.61		4	5.56	22	19	133	52	55	311	22	901	94
ML-228	42.31760	-117.87489	0.33	4.17	2.81	0.89	23	3	7.09	25	29	129	139	59	338	22	1,096	91
ML-236	42.14196	-118.17483	0.25	4.32	2.08	0.84		4	4.25	20	14	91	237	49	272	16	1,911	74
<i>Steens Basalt - Trout Creek Mountains (Tbs)</i>																		
TB-379	42.17482	-118.37179	1.07	1.60	8.46	1.87	321	19	11.02	70	197	100	560	37	181	14	592	54
TB-466	42.17681	-118.36623	0.98	2.21	7.02	2.42	309		10.94	41	174	118	476	44	227	17	845	58
TB-472	42.16414	-118.33920	1.11	2.51	6.05	2.71	229		10.38	29	30	131	436	51	272	19	924	76

ML-230A	42.05251	-118.43543	0.88	0.97	8.56	2.80	396	16	12.10	78	238	117	541	38	197	14	479	49
ML-230B	42.05251	-118.43543	1.00	1.43	8.34	2.05	368	36	11.23	86	203	100	501	37	179	13	468	44
ML-231	42.05297	-118.43435	0.78	1.01	9.62	2.07	356	24	10.05	71	174	95	630	30	144	11	429	42
ML-232	42.05343	-118.43355	0.41	0.63	9.56	1.32	291	125	10.75	154	137	84	443	23	96	8	244	18
ML-233	42.05414	-118.43273	1.25	2.22	6.91	2.57	301		10.46	33	160	116	447	49	264	18	802	73

Trachyandesite and Trachyte lavas - Trout Creek Mountains (Tt)

TB-336	42.16788	-118.45070	1.10	2.23	6.59	2.49	244		10.08	29	58	124	448	49	266	18	871	78
TB-340	42.17198	-118.45510	0.33	3.45	1.90	0.72		3	5.69	18	11	104	273	61	282	17	1,960	78
TB-378	42.16556	-118.37679	0.28	3.81	1.90	0.85		2	6.09	24	16	122	313	64	327	19	2,940	75
TB-477	42.17013	-118.31868	0.33	3.43	2.43	0.84		4	6.29	20	20	130	296	62	326	20	2,220	85
TB-479	42.17239	-118.30889	0.28	3.76	2.22	0.83		2	5.77	22	14	126	312	64	326	20	2,164	87
TB-480	42.18002	-118.29601	0.11	4.98	0.75	0.57		2	4.89	20	13	96	44	34	247	16	2,440	52
TB-481	42.17801	-118.29655	0.30	3.85	2.11	0.82		2	6.03	24	11	126	308	58	324	19	2,126	83
TB-494	42.23647	-118.12156	1.67	2.84	5.32	1.75	80		8.06	24	14	109	527	50	219	13	1,948	73
TB-602	42.07038	-118.22844	0.52	3.38	3.05	1.05	40	1	5.73	22	32	90	356	44	260	16	1,200	70
ML-234	42.05476	-118.43116	0.78	3.49	3.17	1.52		6	6.75	24	20	125	394	49	247	16	2,532	76
ML-301	42.16754	-118.45141	0.49	3.62	2.97	1.28	22		6.29	23	21	135	375	54	316	18	1,103	76
ML-303	42.16832	-118.45245	0.79	3.77	3.49	1.54	15	5	6.41	17	19	111	410	50	247	16	2,315	74
ML-305	42.03152	-118.32048	0.78	3.70	3.66	1.52	6	5	6.75	19	19	117	414	53	245	15	2,358	76

Tule Rims trachybasaltic andesite (Ttrtr)

TB-562	42.31385	-118.37231	0.66	1.66	7.18	1.94	314	9	11.56	50	53	97	495	32	114	10	825	28
TB-565	42.30960	-118.43922	0.56	2.44	6.06	1.37	187	12	8.48	50	38	87	484	33	145	12	1,095	52
TB-570	42.33042	-118.36742	0.76	2.83	5.74	1.31	182	8	9.06	51	60	84	589	39	206	16	638	79

Postcaldera basalts (Tbc)

TB-332	42.18886	-118.36902	0.56	0.42	9.09	1.47	281	26	12.75	138	131	82	299	23	61	8	240	12
TB-471	42.17630	-118.34186	0.48	1.22	8.63	1.44	253	22	11.56	113	127	80	348	35	92	9	357	19
TB-501A	42.20037	-118.33810	0.66	2.27	5.30	2.12	194		8.46	26	23	113	514	48	169	18	921	61
TB-501B	42.20037	-118.33810	0.69	2.40	5.41	2.05	222		8.59	26	24	113	503	48	168	18	955	62
TB-552	42.23013	-118.38531	1.04	1.53	7.71	2.75	286		13.26	37	37	120	769	39	160	18	1,429	47
TB-568	42.34891	-118.40040	1.18	1.86	6.88	2.11	229	10	11.13	43	49	94	512	38	134	13	1,353	49
TB-588	42.25098	-118.24968	1.03	2.59	6.04	1.98	168		9.29	21	21	104	496	44	188	20	869	68

* data in this appendix is not normalized

	P-28			BIR-1A			BCR			AGV-1		
	Measured	Standard	% difference	Measured	Standard	% difference	Measured	Standard	% difference	Measured	Standard	% difference
P (wt. %)	0.14	0.18	0.20	0.02	0.01	-0.99	0.16	0.16	-0.01	0.14	0.11	-0.33
K (wt. %)	3.03	3.17	0.05	0.02	0.02	-0.22	1.53	1.40	-0.09	2.47	2.42	-0.02
Ca (wt. %)	1.98	1.96	-0.01	9.81	9.51	-0.03	4.78	4.97	0.04	3.43	3.53	0.03
Ti (wt. %)	0.77	0.74	-0.04	0.51	0.58	0.11	1.39	1.34	-0.04	0.61	0.63	0.03
V (ppm)	51	61	0.16	297	310	0.04	428	407	-0.05	93	120	0.23
Cr (ppm)	8	12	0.28	372	370	-0.01	5	16	0.68	9	10	0.13
Fe (wt. %)	5	5	-0.04	8	8	0.04	10	9	-0.01	5	5	0.00
Ni (ppm)	27	17	-0.61	166	170	0.02	34	13	-1.61	33	16	-1.06
Cu (ppm)	17	12	-0.42	123	125	0.02	24	19	-0.26	63	60	-0.04
Zn (ppm)	139	136	-0.02	68	70	0.02	127	130	0.02	89	88	-0.01
Sr (ppm)	212	210	-0.01	110	110	0.00	337	330	-0.02	667	660	-0.01
Y (ppm)	57	61	0.07	17	16	-0.03	40	38	-0.05	28	20	-0.38
Zr (ppm)	468	452	-0.04	19	18	-0.08	178	190	0.06	214	227	0.06
Nb (ppm)	98	98	0.00	3	1	-4.00	13	14	0.04	14	15	0.05
Ba (ppm)	1089	1070	-0.02	8	7	-0.16	690	681	-0.01	1207	1230	0.02
Ce (ppm)	127	129	0.02				51	54	0.05	63	67	0.06

Appendix G: Rhyolite EDXRF Data

Sample	Unit	Map			CaO	TiO2	MnO	FeO*	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba	La	Ce	Nd	Th	U
		Symbol	Latitude	Longitude	(wt. %)	(wt. %)	(wt. %)	(wt. %)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Tuff of Oregon Canyon																						
TB-102	Tuff of Oregon Canyon	Tioc	41.95677	-118.74579	0.83	0.22	0.06	2.58	10	177	26	191	15	52	690	31	39	60	107	52	20	3
TB-133	Tuff of Oregon Canyon	Tioc	41.88870	-118.74813	0.24	0.26	0.03	2.58	10	162	25	190	18	71	690	35	209	64	115	60	20	5
TB-215	Tuff of Oregon Canyon	Tioc	42.09420	-118.76440	0.17	0.21	0.04	2.52	6	155	26	195	6	37	725	40	23	59	62	60	20	4
TB-224	Tuff of Oregon Canyon	Tioc	41.96299	-118.74632	0.23	0.23	0.05	2.89	8	201	25	187	18	77	718	39	40	68	142	80	23	8
TB-228	Tuff of Oregon Canyon	Tioc	41.96279	-118.74337	0.69	0.23	0.06	2.63	8	193	25	191	18	65	679	38	43	57	101	50	20	4
TB-257	Tuff of Oregon Canyon	Tioc	42.15579	-118.45510	0.34	0.28	0.04	2.57	10	198	25	199	20	68	757	44	89	68	147	56	20	8
TB-258	Tuff of Oregon Canyon	Tioc	42.15841	-118.45181	0.23	0.18	0.04	2.56	5	153	25	195	7	68	684	34	14	64	140	61	21	3
TB-261	Tuff of Oregon Canyon	Tioc	42.15813	-118.45164	0.44	0.39	0.04	2.89	11	215	23	187	37	90	653	38	173	73	144	59	17	9
TB-264	Tuff of Oregon Canyon	Tioc	42.32369	-118.25404	0.08	0.20	0.01	1.46	2	111	24	197	4	69	701	42	21	41	119	44	19	5
TB-338	Tuff of Oregon Canyon	Tioc	42.16772	-118.45278	0.54	0.38	0.04	3.05	10	199	25	185	58	87	643	36	185	61	128	55	19	8
TB-345	Tuff of Oregon Canyon	Tioc	42.67703	118.39009	1.36	0.53	0.08	4.77	37	142	24	128	55	37	439	25	363	26	75	52	12	3
TB-366	Tuff of Oregon Canyon	Tioc	42.28620	-118.53970	2.21	0.85	0.08	6.20	20	202	23	61	69	45	298	17	1055	29	70	66	8	2
TB-370	Tuff of Oregon Canyon	Tioc	42.28736	-118.54003	0.13	0.21	0.04	2.33	6	203	25	200	5	114	687	39	14	71	146	58	21	9
TB-380B	Tuff of Oregon Canyon	Tioc	42.17300	-118.37319	0.20	0.25	0.04	2.68	14	240	26	199	13	104	709	39	40	83	126	66	24	8
TB-416	Tuff of Oregon Canyon	Tioc	42.52295	-118.74353	0.22	0.23	0.06	2.77	8	197	25	191	10	81	689	38	35	76	156	73	23	9
TB-429	Tuff of Oregon Canyon	Tioc	42.15851	-118.45157	0.67	0.36	0.04	2.88	9	198	24	185	41	110	653	37	128	66	133	54	17	6
TB-430	Tuff of Oregon Canyon	Tioc	42.15863	-118.45163	0.51	0.35	0.05	2.81	12	189	24	182	47	107	653	38	183	71	137	61	17	8
TB-431	Tuff of Oregon Canyon	Tioc	42.15863	-118.45166	0.55	0.32	0.05	2.79	9	211	25	191	35	103	698	41	114	57	138	50	18	7
TB-432	Tuff of Oregon Canyon	Tioc	42.15863	-118.45166	0.35	0.21	0.09	2.42	7	186	26	195	12	60	700	36	70	63	124	53	19	4
TB-433	Tuff of Oregon Canyon	Tioc	42.15866	-118.45172	0.50	0.15	0.05	2.52	6	152	26	197	9	67	714	37	21	75	155	67	21	3
TB-434	Tuff of Oregon Canyon	Tioc	42.15866	-118.45182	0.20	0.20	0.05	2.50	7	139	25	194	11	62	608	33	36	64	143	52	20	3
TB-435	Tuff of Oregon Canyon	Tioc	42.15867	-118.45187	0.52	0.38	0.11	3.94	8	189	26	150	19	58	429	27	267	52	116	51	15	4
TB-436	Tuff of Oregon Canyon	Tioc	42.15877	-118.45211	1.16	0.64	0.33	5.52	11	148	24	113	63	40	364	21	836	39	80	54	11	3
TB-444	Tuff of Oregon Canyon	Tioc	42.26167	-118.00729	0.12	0.26	0.03	1.95	6	143	26	199	6	87	733	33	23	37	125	52	21	4
TB-445	Tuff of Oregon Canyon	Tioc	42.26142	-118.00754	0.30	0.27	0.06	2.88	7	159	26	180	12	70	645	35	44	69	146	68	19	4
TB-453	Tuff of Oregon Canyon	Tioc	42.26145	-118.00526	0.14	0.24	0.02	2.26	5	151	26	195	7	70	704	35	25	41	105	50	21	4
TB-492	Tuff of Oregon Canyon	Tioc	42.23586	-118.12184	0.64	0.19	0.03	1.75	10	126	23	195	14	66	709	39	71	63	132	54	20	5
TB-520	Tuff of Oregon Canyon	Tioc	42.42746	-118.41569	0.66	0.74	0.03	1.88	11	67	21	64	60	68	264	19	1016	19	26	36	8	8
TB-521	Tuff of Oregon Canyon	Tioc	42.22126	-118.42017	2.14	0.85	0.04	2.41	5	33	16	68	391	75	228	27	1532	34	50	26	5	4
TB-525	Tuff of Oregon Canyon	Tioc	42.31294	-118.46549	0.83	0.75	0.05	5.65	9	131	24	98	41	42	329	18	850	37	74	64	8	5
TB-526B	Tuff of Oregon Canyon	Tioc	42.31274	-118.46568	0.40	0.29	0.02	1.46	8	91	22	131	27	36	476	27	1161	53	101	52	12	5
TB-527	Tuff of Oregon Canyon	Tioc	42.35809	-118.51115	0.32	0.35	0.01	1.75	8	112	23	130	28	59	423	24	1230	44	83	48	12	5
TB-559	Tuff of Oregon Canyon	Tioc	42.25679	-118.42319	0.47	0.68	0.04	5.23	12	270	27	109	27	47	380	23	525	41	92	65	10	11
TB-574	Tuff of Oregon Canyon	Tioc	42.33103	-118.19445	0.28	0.21	0.02	2.08	7	158	24	195	13	86	685	39	33	75	146	55	19	5
TB-575	Tuff of Oregon Canyon	Tioc	42.32801	-118.18168	0.20	0.26	0.05	2.68	9	152	24	159	13	92	638	35	115	57	138	60	16	4
TB-576A	Tuff of Oregon Canyon	Tioc	42.32734	-118.18269	0.22	0.36	0.10	4.05	9	198	27	138	9	70	514	28	64	51	113	64	14	7
TB-576B	Tuff of Oregon Canyon	Tioc	42.32734	-118.18269	0.25	0.41	0.03	4.16	17	196	28	136	10	52	529	30	51	60	106	56	13	6
TB-577	Tuff of Oregon Canyon	Tioc	42.32598	-118.18806	0.87	0.61	0.03	3.60	5	144	21	110	69	54	373	23	1109	40	84	47	9	4
TB-578A	Tuff of Oregon Canyon	Tioc	42.33702	-118.14031	0.25	0.35	0.03	1.89	4	148	21	146	19	73	494	32	274	48	98	44	12	7
TB-578B	Tuff of Oregon Canyon	Tioc	42.33702	-118.14031	1.02	0.72	0.03	5.08	6	141	22	101	112	49	338	20	1273	36	78	45	8	4
TB-578C	Tuff of Oregon Canyon	Tioc	42.33702	-118.14031	1.16	0.37	0.03	3.47	4	93	23	143	43	36	422	25	278	40	95	41	13	1
TB-578Cf	Tuff of Oregon Canyon	Tioc	42.33702	-118.14031	1.23	0.46	0.05	2.74	5	213	18	107	81	48	401	26	737	30	96	32	7	2
TB-580	Tuff of Oregon Canyon	Tioc	42.35153	-118.14717	0.51	0.69	0.04	4.05	7	160	23	106	46	52	375	24	1006	32	67	51	10	10
TB-595	Tuff of Oregon Canyon	Tioc	42.67218	-118.30680	1.51	0.24	0.05	2.53	21	221	26	129	95	74	738	47	45	63	133	39	14	3
TB-601B	Tuff of Oregon Canyon	Tioc	42.15345	-118.27763	2.22	1.08	0.34	8.10	30	130	23	88	124	33	268	16	1633	27	74	79	7	2
TB-601L1	Tuff of Oregon Canyon	Tioc	42.15345	-118.27763	0.22	0.22	0.06	2.52	4	175	26	196	6	47	607	32	27	43	96	48	18	6
ML-304	Tuff of Oregon Canyon	Tioc	42.03048	-118.31897	0.22	0.23	0.05	2.67	6	181	25	199	18	32	622	36	48	20	96	31	19	4

Tuff of Trout Creek Mountains

TB-225A	Tuff of Trout Creek Mountains	Titc	41.96330	-118.74812	0.43	0.36	0.03	3.32	14	143	29	112	22	48	417	22	94	41	66	53	11	3
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TB-225B	Tuff of Trout Creek Mountains	Titc	41.96330	-118.74812	0.22	0.34	0.11	4.20	8	204	27	130	9	68	483	23	70	41	93	118	18	6
TB-249	Tuff of Trout Creek Mountains	Titc	42.09210	-118.57826	0.37	0.29	0.04	3.74	12	124	25	97	19	32	335	20	202	31	79	46	9	2
TB-251	Tuff of Trout Creek Mountains	Titc	42.09048	-118.58061	0.40	0.30	0.05	2.88	6	125	25	100	16	31	341	19	100	28	84	40	9	2
TB-254	Tuff of Trout Creek Mountains	Titc	42.29995	-118.81105	0.25	0.35	0.05	3.42	6	178	26	118	30	50	449	25	251	89	65	71	12	4
TB-255	Tuff of Trout Creek Mountains	Titc	42.15487	-118.45924	0.24	0.31	0.07	3.59	5	147	26	127	9	50	461	24	47	18	59	53	13	
TB-256	Tuff of Trout Creek Mountains	Titc	42.15626	-118.45720	0.35	0.27	0.06	4.17	8	247	30	201	10	35	834	37	21	47	87	59	24	4
TB-259	Tuff of Trout Creek Mountains	Titc	42.15857	-118.45186	0.74	0.49	0.13	4.96	9	175	24	131	35	50	486	27	614	54	118	77	13	4
TB-260	Tuff of Trout Creek Mountains	Titc	42.15849	-118.45244	0.22	0.27	0.12	4.88	11	307	28	217	11	100	944	39	65	86	198	174	31	11
TB-262	Tuff of Trout Creek Mountains	Titc	42.15849	-118.45244	0.22	0.26	0.09	3.89	10	269	27	195	8	101	841	39	27	81	183	82	22	9
TB-265A	Tuff of Trout Creek Mountains	Titc	42.30632	-118.32468	0.24	0.27	0.08	3.17	7	164	25	119	14	64	461	23	172	44	103	66	13	5
TB-265B	Tuff of Trout Creek Mountains	Titc	42.30632	-118.32468	0.14	0.26	0.07	2.88	6	152	26	123	7	67	438	25	92	49	103	59	11	4
TB-334	Tuff of Trout Creek Mountains	Titc	42.21591	-118.42984	0.27	0.39	0.06	3.54	7	121	27	105	21	53	343	20	204	32	67	58	11	
TB-335	Tuff of Trout Creek Mountains	Titc	42.16296	-118.43580	0.20	0.30	0.10	4.30	9	261	28	199	6	48	841	40	49	40	144	58	24	
TB-339	Tuff of Trout Creek Mountains	Titc	42.16812	-118.45359	0.30	0.29	0.08	4.31	8	273	29	200	11	71	859	33	33	60	104	81	25	
TB-341	Tuff of Trout Creek Mountains	Titc	42.31690	-118.19619	0.29	0.32	0.09	2.63	10	121	25	111	17	41	366	21	128	27	65	41	11	
TB-346	Tuff of Trout Creek Mountains	Titc	42.48009	-118.37859	0.38	0.34	0.04	2.14	7	138	27	163	22	66	519	26	130	46	102	48	19	
TB-347B	Tuff of Trout Creek Mountains	Titc	42.48657	-118.37910	0.37	0.31	0.08	3.49	7	197	26	140	17	74	488	25	102	44	103	57	14	5
TB-348	Tuff of Trout Creek Mountains	Titc	42.50688	-118.36958	0.82	0.38	0.04	3.97	11	201	26	158	34	65	578	32	122	61	103	49	15	
TB-349	Tuff of Trout Creek Mountains	Titc	42.50698	-118.36960	0.26	0.38	0.18	1.35	10	77	18	94	39	44	291	22	260	21	53	27	7	
TB-359	Tuff of Trout Creek Mountains	Titc	42.24065	-118.16669	0.52	0.28	0.12	4.68	13	275	27	189	32	94	816	34	59	68	156	151	28	
TB-360	Tuff of Trout Creek Mountains	Titc	42.24065	-118.16669	0.22	0.29	0.11	3.83	8	208	26	146	6	75	577	26	32	52	113	83	19	
TB-361	Tuff of Trout Creek Mountains	Titc	42.24065	-118.16669	0.18	0.28	0.06	3.04	5	164	25	122	7	49	471	25	38	31	78	55	13	
TB-364	Tuff of Trout Creek Mountains	Titc	42.16058	-118.27713	0.44	0.35	0.10	4.00	8	180	27	145	21	35	554	27	109	34	73	49	16	
TB-368A	Tuff of Trout Creek Mountains	Titc	42.28612	-118.53942	0.20	0.28	0.11	4.44	10	286	27	197	7	97	873	38	19	74	162	107	27	
TB-368B	Tuff of Trout Creek Mountains	Titc	42.28612	-118.53942	0.20	0.28	0.07	3.75	5	248	27	197	7	99	833	33	16	58	151	67	22	
TB-377	Tuff of Trout Creek Mountains	Titc	42.15203	-118.38088	0.20	0.30	0.06	4.15	6	221	28	185	7	44	725	31	26	41	70	56	22	
TB-381	Tuff of Trout Creek Mountains	Titc	42.16952	-118.37212	0.23	0.30	0.10	3.66	7	204	27	142	7	56	525	25	47	39	87	56	16	
TB-399	Tuff of Trout Creek Mountains	Titc	42.05611	-118.74860	0.19	0.26	0.05	2.67	8	172	26	192	15	41	672	35	52	53	100	58	20	
TB-400A	Tuff of Trout Creek Mountains	Titc	42.05544	-118.74989	0.24	0.23	0.07	3.05	12	254	26	195	11	101	757	38	30	90	135	97	26	
TB-400B	Tuff of Trout Creek Mountains	Titc	42.05544	-118.74989	0.16	0.26	0.04	2.68	12	263	26	193	11	98	688	39	32	87	119	70	21	
TB-402	Tuff of Trout Creek Mountains	Titc	42.16071	-118.61413	0.35	0.18	0.04	2.08	6	129	22	165	12	60	521	32	36	43	104	43	15	
TB-403	Tuff of Trout Creek Mountains	Titc	float in Pueblo Mtns		0.18	0.27	0.06	3.66	4	236	26	187	5	68	784	35	21	43	118	52	20	
TB-406	Tuff of Trout Creek Mountains	Titc	42.10251	-118.58645	0.60	0.18	0.03	1.77	13	102	19	153	12	49	526	37	74	41	87	38	14	4
TB-407	Tuff of Trout Creek Mountains	Titc	42.10250	-118.58656	0.17	0.29	0.10	4.08	11	295	28	218	5	104	872	40	20	76	162	85	24	
TB-408	Tuff of Trout Creek Mountains	Titc	42.10191	-118.58705	0.11	0.31	0.02	3.80	8	201	30	211	9	95	793	38	20	65	149	83	27	
TB-409	Tuff of Trout Creek Mountains	Titc	42.10253	-118.58990	0.47	0.30	0.03	3.48	9	191	28	201	21	89	941	36	33	69	171	81	26	
TB-410	Tuff of Trout Creek Mountains	Titc	42.10552	-118.59209	0.16	0.29	0.06	3.87	5	196	28	203	5	44	806	24	37	53	67	64	23	
TB-411	Tuff of Trout Creek Mountains	Titc	41.96430	-118.46585	0.36	0.61	0.21	5.66	15	133	24	110	44	29	388	22	617	26	55	57	12	
TB-412	Tuff of Trout Creek Mountains	Titc	41.96411	-118.46707	0.70	0.45	0.16	4.03	10	125	21	113	27	42	366	22	350	31	74	43	11	
TB-437A	Tuff of Trout Creek Mountains	Titc	42.15872	-118.45243	0.24	0.29	0.09	3.90	10	272	28	189	10	112	873	40	117	86	188	84	22	10
TB-437B	Tuff of Trout Creek Mountains	Titc	42.15872	-118.45243	0.34	0.25	0.10	4.08	11	269	27	190	6	96	864	38	36	84	190	92	24	8
TB-438	Tuff of Trout Creek Mountains	Titc	42.15860	-118.45258	0.56	0.28	0.08	4.08	8	261	29	198	12	75	852	35	59	56	185	61	22	4
TB-439	Tuff of Trout Creek Mountains	Titc	42.15867	-118.45271	0.96	0.29	0.09	4.07	11	267	28	195	29	73	831	37	182	67	164	62	21	3
TB-440	Tuff of Trout Creek Mountains	Titc	42.15869	-118.45292	0.31	0.30	0.14	3.56	8	157	26	138	15	40	530	27	129	26	110	49	15	2
TB-441	Tuff of Trout Creek Mountains	Titc	42.15867	-118.45322	0.25	0.30	0.08	3.78	6	161	28	141	4	37	534	26	25	47	58	66	16	2
TB-442	Tuff of Trout Creek Mountains	Titc	42.15867	-118.45322	0.27	0.31	0.07	3.51	7	151	27	131	7	62	471	24	68	38	110	50	13	3
TB-443	Tuff of Trout Creek Mountains	Titc	42.15890	-118.45338	0.37	0.37	0.07	3.76	9	133	26	100	22	44	339	19	208	32	71	54	10	3
TB-451	Tuff of Trout Creek Mountains	Titc	42.25564	-118.01474	0.32	0.44	0.12	4.00	9	135	26	115	21	37	422	23	248	34	76	55	12	3
TB-456	Tuff of Trout Creek Mountains	Titc	42.23906	-118.11455	0.67	0.31	0.09	3.91	8	251	27	182	22	81	788	37	92	66	170	66	19	5
TB-474	Tuff of Trout Creek Mountains	Titc	42.16788	-118.31411	0.17	0.26	0.07	3.25	6	171	27	138	7	59	563	29	53	53	81	63	16	3
TB-475	Tuff of Trout Creek Mountains	Titc	42.16909	-118.31446	0.23	0.21	0.05	2.51	9	201	25	200	10	63	728	41	30	69	138	57	21	7
TB-476	Tuff of Trout Creek Mountains	Titc	42.16966	-118.31533	0.33	0.28	0.10	3.67	11	252	28	191	17	107	827	40	221	87	182	81	21	8
TB-482	Tuff of Trout Creek Mountains	Titc	42.18782	-118.27436	0.20	0.28	0.11	4.60	10	293	28	202	16	116	901	38	110	84	174	134	29	10
TB-484	Tuff of Trout Creek Mountains	Titc	42.23944	-118.16778	0.19	0.26	0.07	2.97	7	171	25	129	6	72	491	25	48	50	104	49	13	6
TB-487A	Tuff of Trout Creek Mountains	Titc	42.23509	-118.14529	0.39	0.30	0.05	2.83	5	167	26	129	11	66	454	23	47	48	70	45	12	4
TB-487B	Tuff of Trout Creek Mountains	Titc	42.23509	-118.14529	0.20	0.28	0.08	3.41	7	179	25	136	4	67	505	25	34	45	98	74	16	6
TB-489	Tuff of Trout Creek Mountains	Titc	42.23711	-118.14308	0.40	0.45	0.03	3.08	5	140	25	125	24	50	463	23	109	38	82	43	12	5
TB-490	Tuff of Trout Creek Mountains	Titc	42.23988	-118.13392	0.57	0.52	0.07	4.00	7	75	18	86	44	34	258	18	890	26	59	40	6	5

TB-523A	Tuff of Trout Creek Mountains	Titc	42.31301	-118.46471	0.18	0.28	0.10	3.53	9	192	26	142	3	75	579	28	24	58	126	87	17	7
TB-523B	Tuff of Trout Creek Mountains	Titc	42.31301	-118.46471	0.19	0.31	0.04	2.96	5	165	26	143	7	79	547	25	29	50	104	61	15	5
TB-524	Tuff of Trout Creek Mountains	Titc	42.31301	-118.46471	0.16	0.34	0.06	2.11	7	84	27	113	9	64	382	21	94	36	75	56	11	3
TB-556	Tuff of Trout Creek Mountains	Titc	42.25378	-118.41910	0.06	0.29	0.01	1.71	3	82	26	142	5	82	501	26	25	31	103	42	14	6
TB-564	Tuff of Trout Creek Mountains	Titc	42.30626	-118.44143	0.38	0.36	0.02	2.62	15	120	28	114	14	37	422	23	78	24	77	35	10	3
TB-581	Tuff of Trout Creek Mountains	Titc	42.35571	-118.16152	0.49	0.38	0.07	3.44	12	182	27	137	16	60	520	27	121	49	109	52	13	4
TB-587	Tuff of Trout Creek Mountains	Titc	42.23177	-118.14407	0.42	0.31	0.09	3.50	10	205	27	164	27	75	642	32	257	49	141	56	16	5
TB-604	Tuff of Trout Creek Mountains	Titc	42.07428	-118.20325	0.36	0.41	0.12	3.50	8	124	27	104	23	33	362	21	137	32	74	49	10	3
TB-606B	Tuff of Trout Creek Mountains	Titc	42.06816	-118.15829	0.21	0.32	0.11	3.77	9	211	27	140	11	73	533	26	64	48	108	75	16	7
TB-612	Tuff of Trout Creek Mountains	Titc	42.34831	-117.83201	0.14	0.42	0.07	3.48	9	142	26	113	19	50	415	24	463	18	46	43	11	4
EW-101	Tuff of Trout Creek Mountains	Titc	42.28169	-118.06816	0.48	0.58	0.14	4.14	12	170	27	114	35	66	402	22	276	49	83	59	10	9
EW-102	Tuff of Trout Creek Mountains	Titc	42.41937	-118.39911	0.17	0.33	0.01	0.93	1	89	22	91	12	44	335	21	146	24	72	36	8	4
EW-209	Tuff of Trout Creek Mountains	Titc	42.34243	-117.88123	0.29	0.35	0.08	3.33	10	160	25	117	17	65	437	23	145	44	102	54	12	5
ML-206	Tuff of Trout Creek Mountains	Titc	42.29679	-117.94602	0.53	0.39	0.13	3.46	9	143	26	116	34	32	449	25	355	27	110	53	11	2
ML-209B	Tuff of Trout Creek Mountains	Titc	42.34211	-117.96329	0.53	0.35	0.12	3.66	8	174	26	123	13	68	472	24	102	49	109	75	13	4
ML-213	Tuff of Trout Creek Mountains	Titc	42.33084	-117.94741	0.38	0.37	0.12	3.26	9	138	27	115	36	40	425	24	547	46	131	57	11	2
ML-215	Tuff of Trout Creek Mountains	Titc	42.30856	-117.91747	0.45	0.41	0.11	3.45	12	131	26	111	27	34	411	23	170	37	94	50	11	2
ML-219	Tuff of Trout Creek Mountains	Titc	42.25886	-117.90849	0.54	0.43	0.11	3.72	14	148	27	110	36	87	413	22	201	58	96	72	11	4
ML-229	Tuff of Trout Creek Mountains	Titc	42.32170	-117.87295	0.32	0.36	0.09	3.25	8	157	26	117	25	40	369	24	194	35	86	51	11	4

Tuff of Long Ridge

TB-134A	Tuff of Long Ridge	Tilr	41.50017	-118.61608	0.59	0.39	0.02	3.20	11	129	22	155	47	61	348	22	776	43	68	53	16	6
TB-134B	Tuff of Long Ridge	Tilr	41.50017	-118.61608	1.11	0.41	0.11	4.05	10	155	23	146	49	55	342	21	1166	43	84	63	17	4
TB-145	Tuff of Long Ridge	Tilr	42.24402	-117.98764	0.24	0.32	0.07	3.45	6	115	26	180	13	35	430	24	342	33	59	57	21	5
TB-146	Tuff of Long Ridge	Tilr	42.23993	-117.99917	1.96	0.52	0.02	3.18	9	93	21	139	217	32	313	22	1968	45	85	44	13	3
TB-226	Tuff of Long Ridge	Tilr	41.96416	-118.75057	0.30	0.39	0.03	3.41	7	143	22	165	30	39	368	24	668	57	77	60	16	9
TB-232	Tuff of Long Ridge	Tilr	41.68736	-118.96021	0.32	0.31	0.09	3.71	9	173	25	191	13	61	463	23	136	45	97	164	32	9
TB-268	Tuff of Long Ridge	Tilr	float in Pueblo Mtns		0.64	0.30	0.10	1.80	5	72	21	177	38	52	410	28	578	47	106	62	22	6
TB-413	Tuff of Long Ridge	Tilr	41.96402	-118.46824	0.34	0.33	0.07	3.36	7	159	26	188	14	41	450	25	129	34	48	61	22	
TB-452	Tuff of Long Ridge	Tilr	42.25548	-118.01513	0.39	0.33	0.05	4.08	7	142	25	166	28	46	373	22	619	45	89	72	19	7
TB-454	Tuff of Long Ridge	Tilr	42.28121	-118.06619	0.31	0.31	0.08	3.21	9	165	26	193	14	53	491	26	94	49	118	74	22	7
TB-455	Tuff of Long Ridge	Tilr	42.24698	-118.12354	0.48	0.35	0.12	4.03	8	149	24	167	15	52	403	21	362	41	92	105	24	7
TB-483	Tuff of Long Ridge	Tilr	42.18581	-118.23918	0.18	0.45	0.04	3.66	5	125	23	159	20	39	359	22	762	37	60	54	17	15
TB-518	Tuff of Long Ridge	Tilr	42.36390	-118.14985	1.26	0.43	0.05	3.12	10	148	24	162	64	65	374	23	485	39	82	44	17	5
TB-582A	Tuff of Long Ridge	Tilr	42.22274	-118.17183	0.76	0.38	0.10	3.93	7	132	23	162	20	51	369	19	620	38	93	104	23	6
TB-582B	Tuff of Long Ridge	Tilr	42.22274	-118.17183	0.39	0.33	0.03	2.88	3	95	19	143	32	32	303	20	520	20	63	30	12	6
TB-583	Tuff of Long Ridge	Tilr	42.22181	-118.16881	0.61	0.45	0.05	4.01	12	133	25	163	48	39	362	20	578	34	87	46	17	8
TB-584	Tuff of Long Ridge	Tilr	42.21431	-118.15776	0.40	0.36	0.07	3.42	6	120	23	157	31	37	348	21	643	29	64	46	15	7
TB-596	Tuff of Long Ridge	Tilr	42.68344	-118.17466	0.62	0.28	0.08	3.11	10	167	25	187	16	67	471	25	81	47	101	64	23	6
TB-603	Tuff of Long Ridge	Tilr	42.07429	-118.20849	0.25	0.36	0.03	3.69	6	143	24	164	25	36	345	20	455	48	68	62	17	10
TB-605	Tuff of Long Ridge	Tilr	42.08184	-118.18592	0.35	0.34	0.06	3.69	5	123	25	174	25	24	390	23	449	16	74	48	18	7
TB-611B	Tuff of Long Ridge	Tilr	42.43557	-117.82701	1.16	0.33	0.08	3.09	7	143	24	184	30	55	429	25	148	52	99	46	19	3
TB-613A	Tuff of Long Ridge	Tilr	42.35167	-117.82856	1.00	0.40	0.09	3.71	13	172	24	163	57	67	435	25	287	45	97	54	18	5
TB-613B	Tuff of Long Ridge	Tilr	42.35167	-117.82856	0.66	0.39	0.07	3.51	7	173	25	169	36	71	445	26	253	49	94	61	19	7
TB-613C	Tuff of Long Ridge	Tilr	42.35167	-117.82856	0.19	0.38	0.04	2.88	7	146	24	189	20	98	476	30	306	50	104	48	18	13
EW-201	Tuff of Long Ridge	Tilr	42.33298	-117.87692	0.74	0.35	0.18	4.12	11	123	25	157	30	34	284	16	677	32	74	61	17	4
EW-205	Tuff of Long Ridge	Tilr	42.31221	-117.98046	0.76	0.41	0.13	4.19	11	143	24	165	27	52	361	20	569	40	95	82	19	6
EW-208	Tuff of Long Ridge	Tilr	42.25315	-117.97984	0.42	0.31	0.09	2.94	11	142	26	185	13	55	448	27	224	48	116	57	19	4
EW-210	Tuff of Long Ridge	Tilr	42.34286	-117.88136	0.39	0.36	0.15	3.97	11	120	24	163	28	36	363	21	739	36	100	64	18	7
EW-211	Tuff of Long Ridge	Tilr	42.34282	-117.88141	0.66	0.42	0.12	3.71	10	134	24	161	30	60	382	22	630	46	87	58	16	7
EW-212	Tuff of Long Ridge	Tilr	42.34290	-117.88182	0.69	0.39	0.12	3.98	9	139	24	162	25	51	384	21	630	41	98	91	20	6
EW-213	Tuff of Long Ridge	Tilr	42.34311	-117.88191	0.88	0.31	0.07	2.79	9	159	25	187	28	61	473	30	174	63	111	48	18	3
ML-205	Tuff of Long Ridge	Tilr	42.32137	-117.87562	0.34	0.30	0.09	2.95	6	142	25	182	12	58	453	27	222	46	121	53	19	5
ML-207	Tuff of Long Ridge	Tilr	42.29664	-117.94626	0.51	0.35	0.10	3.58	8	135	24	175	19	54	415	24	387	43	107	68	20	4
ML-208	Tuff of Long Ridge	Tilr	42.34201	-117.96427	0.23	0.32	0.02	3.44	8	139	25	176	19	46	422	24	287	42	65	62	20	8
ML-211	Tuff of Long Ridge	Tilr	42.33017	-117.94843	0.22	0.35	0.03	3.41	6	130	24	178	16	37	432	24	296	27	64	50	20	8
ML-212	Tuff of Long Ridge	Tilr	42.33116	-117.94813	0.40	0.34	0.11	3.54	9	141	25	173	19	44	396	23	402	38	93	65	20	5

ML-214	Tuff of Long Ridge	Tilr	42.32900	-117.92343	0.83	0.39	0.13	4.05	8	141	24	161	23	54	391	21	538	45	100	88	20	5
ML-216	Tuff of Long Ridge	Tilr	42.30855	-117.91772	0.46	0.27	0.09	3.14	7	143	25	189	11	57	441	26	137	50	112	62	22	5
ML-217	Tuff of Long Ridge	Tilr	42.30843	-117.91812	0.20	0.34	0.05	3.37	13	165	25	181	18	57	435	25	215	34	77	53	21	10
ML-218	Tuff of Long Ridge	Tilr	42.26556	-117.90865	0.43	0.30	0.08	3.14	8	145	26	185	10	55	461	26	153	45	98	59	22	4
ML-235	Tuff of Long Ridge	Tilr	42.05475	-118.43050	0.23	0.30	0.31	3.05	10	177	25	186	14	60	455	27	498	36	94	49	20	8

Tuff of Whitehorse Creek

TB-312A-D	Tuff of Whitehorse Ck	Tiwc	42.32533	-118.38132	0.45	0.22	0.05	3.05	21	113	23	184	27	53	493	34	57	55	106	63	22	6
TB-312A-L	Tuff of Whitehorse Ck	Tiwc	42.32533	-118.38132	1.08	0.18	0.05	2.86	27	111	25	183	30	53	492	32	49	51	112	73	24	4
TB-312B	Tuff of Whitehorse Ck	Tiwc	42.32533	-118.38132	1.41	0.16	0.04	2.33	20	100	23	188	87	55	477	31	18	50	94	51	21	4
TB-322	Tuff of Whitehorse Ck	Tiwc	42.22749	-118.23219	1.25	0.26	0.07	2.95	14	111	25	194	68	54	547	40	103	49	114	44	19	4
TB-343	Tuff of Whitehorse Ck	Tiwc	42.24080	-118.22108	0.11	0.17	0.03	2.09	7	111	24	202	8	58	536	40	25	49	86	48	21	7
TB-352	Tuff of Whitehorse Ck	Tiwc	42.35210	-118.19310	0.19	0.18	0.04	2.51	11	120	24	185	18	66	541	36	44	53	107	79	26	8
TB-478	Tuff of Whitehorse Ck	Tiwc	42.17675	-118.30975	0.82	0.33	0.09	3.97	19	119	24	181	46	52	503	36	92	50	103	46	18	5
TB-519	Tuff of Whitehorse Ck	Tiwc	42.42097	-118.39715	1.06	0.32	0.05	3.80	8	165	23	184	24	55	410	23	132	42	94	49	18	5
TB-522A	Tuff of Whitehorse Ck	Tiwc	42.31314	-118.48327	0.61	0.18	0.07	2.62	15	114	24	207	32	57	509	35	42	52	101	58	22	5
TB-522B	Tuff of Whitehorse Ck	Tiwc	42.31314	-118.48327	1.09	0.21	0.05	2.98	15	104	22	188	43	57	494	32	60	48	108	71	23	4
TB-522C	Tuff of Whitehorse Ck	Tiwc	42.31314	-118.48327	0.76	0.18	0.02	1.86	9	96	22	189	24	57	531	41	37	57	131	42	18	4
TB-551	Tuff of Whitehorse Ck	Tiwc	42.19563	-118.36134	4.14	0.16	0.05	2.82	9	99	21	180	77	54	482	30	99	45	107	51	20	2
TB-553	Tuff of Whitehorse Ck	Tiwc	42.24478	-118.42454	1.50	0.33	0.06	3.12	20	108	23	189	72	58	471	35	115	50	97	39	16	3
TB-553P	Tuff of Whitehorse Ck	Tiwc	42.24478	-118.42454	0.57	0.16	0.07	2.76	17	112	24	214	16	53	510	32	16	46	95	67	25	5
TB-554	Tuff of Whitehorse Ck	Tiwc	42.24480	-118.42429	0.77	0.27	0.04	2.52	14	113	22	195	70	62	485	37	358	53	99	46	18	5
TB-554P	Tuff of Whitehorse Ck	Tiwc	42.24480	-118.42429	0.40	0.17	0.06	2.73	10	110	23	200	14	54	481	32	50	49	102	64	24	6
TB-555	Tuff of Whitehorse Ck	Tiwc	42.24480	-118.42426	0.56	0.21	0.03	2.82	9	103	22	200	43	58	519	38	75	53	107	55	20	6
TB-566	Tuff of Whitehorse Ck	Tiwc	42.31015	-118.43772	0.25	0.18	0.02	2.15	12	102	23	192	20	56	517	41	47	52	105	40	17	7
W7-450	Tuff of Whitehorse Ck, intracaldera	Tiwc	42.20448	-118.33549	1.01	0.21	0.06	2.68	9	134	25	204	33	70	563	45	40	57	109	38	17	5
W7-488	Tuff of Whitehorse Ck, intracaldera	Tiwc	42.20448	-118.33549	0.77	0.19	0.05	2.64	9	116	24	215	25	51	543	41	31	50	94	42	19	4
W7-512	Tuff of Whitehorse Ck, intracaldera	Tiwc	42.20448	-118.33549	0.74	0.20	0.05	2.74	10	129	26	208	26	57	480	36	34	53	96	37	18	5
W7-522	Tuff of Whitehorse Ck, intracaldera	Tiwc	42.20448	-118.33549	0.68	0.20	0.05	2.62	8	110	24	201	21	54	478	34	52	53	97	47	19	5

Lavas

OCT-related lavas

TB-266	North Red Mountain rhyolite lava	Tloo	42.31038	-118.32269	0.37	0.19	0.04	2.02	5	103	20	168	10	52	552	30	178	50	132	55	18	5
TB-309	North Red Mountain rhyolite lava	Tloo	42.32440	-118.29716	0.15	0.20	0.01	1.80	9	98	24	174	10	63	563	32	199	43	96	50	19	7
TB-310	North Red Mountain rhyolite lava	Tloo	42.32365	-118.29129	0.05	0.20	0.01	0.90	7	45	24	185	4	50	587	33	163	43	78	52	21	8
TB-571	North Red Mountain rhyolite lava	Tloo	42.32951	-118.32822	0.32	0.19	0.01	1.54	4	105	21	175	12	59	537	31	149	58	97	47	17	6
TB-355	Whitehorse Canyon rhyolite lava	Tloo	42.23749	-118.15452	0.11	0.17	0.09	1.95	10	101	22	170	5	40	548	33	177	38	95	43	16	6
TB-486	Whitehorse Canyon rhyolite lava	Tloo	42.23459	-118.15136	0.14	0.15	0.01	1.08	5	64	19	151	6	58	518	32	53	48	93	37	13	6
TB-488	Whitehorse Canyon rhyolite lava	Tloo	42.23518	-118.14332	0.12	0.17	0.03	1.76	11	90	21	168	7	74	613	38	63	58	142	52	16	7
TB-493	Whitehorse Canyon rhyolite lava	Tloo	42.23578	-118.12193	0.22	0.13	0.02	0.99	5	69	20	147	30	42	520	37	98	32	58	24	12	5
TB-586	Whitehorse Canyon rhyolite lava	Tloo	42.23179	-118.14403	0.10	0.13	0.02	1.19	4	81	19	154	8	63	535	33	58	46	99	38	14	6
TB-306	Antelope Creek rhyolite lava	Tloo	42.34863	-118.15720	0.14	0.21	0.03	2.37	4	209	24	170	11	86	697	37	127	57	146	58	18	7
TB-353	Antelope Creek rhyolite lava	Tloo	42.31555	-118.18646	0.27	0.25	0.05	2.31	5	165	25	160	9	75	682	34	118	55	132	51	15	4
TB-517	Antelope Creek rhyolite lava	Tloo	42.34693	-118.15824	0.90	0.21	0.03	2.15	10	174	25	167	12	86	687	30	112	62	130	51	16	2
TB-601L2	Lithic of pre-caldera rhyolite lava in Tio	Tloo			0.18	0.20	0.05	2.32	5	164	25	200	4	62	672	38	24	55	124	52	18	7

TCT-related rhyolite Lavas

TB-354	Fish Creek rhyolite lava	Tlto	42.28041	-118.18412	0.26	0.28	0.03	3.80	8	158	28	169	13	103	775	38	80	82	184	71	18	4
TB-516	Fish Creek rhyolite lava	Tlto	42.29368	-118.14030	0.57	0.27	0.08	3.39	11	165	28	171	22	93	722	33	72	65	148	62	18	3
TB-464	Pole Canyon Volcanics rhyolite lava	Tlty	42.17849	-118.36721	0.14	0.30	0.01	0.69	3	52	23	180	15	120	561	30	1044	67	110	56	16	10
TB-319	Pole Canyon Volcanics rhyodacite lava	Tlty	42.19081	-118.38354	0.88	0.43	0.10	5.93	10	108	23	148	56	63	300	16	952	75	188	122	15	5

Perlitic rhyolite lava of Tule Rims

TB-567	Perlitic rhyolite lava of Tule Rims	Trtr	42.34089	-118.40108	0.39	0.17	0.03	1.13	5	47	18	204	23	51	216	20	228	38	82	61	30	8
TB-569	Perlitic rhyolite lava of Tule Rims	Trtr	42.35966	-118.39462	0.42	0.17	0.03	1.11	6	48	18	204	23	51	212	22	226	38	84	53	29	7

Pre-caldera whitehorse lavas

TB-263	Camp turnoff rhyolite lava	Tlwo	42.29888	-118.26780	0.15	0.08	0.00	0.40	3	26	20	241	6	44	328	49	22	22	54	30	17	5
TB-307	Camp turnoff rhyolite lava	Tlwo	42.29710	-118.26900	0.14	0.09	0.01	1.03	5	54	22	224	6	57	305	47	31	39	86	37	21	4
TB-320	North Whitehorse Butte rhyolite lava	Tlwo	42.26797	-118.24235	0.37	0.09	0.03	1.13	6	58	22	240	12	61	414	47	20	43	91	39	21	5
TB-342	Whitehorse Butte rhyolite lava	Tlwo	42.24840	-118.21720	1.68	0.08	0.03	1.08	12	60	21	250	24	57	273	46	31	35	77	31	18	3
TB-609	NE Campground rhyolite lava	Tlwo	42.28671	-118.24941	0.08	0.07	0.01	0.74	6	59	20	244	3	63	285	49	14	36	67	32	18	6
TB-362A	Bearclaw rhyolite lava	Tlwo	42.18745	-118.32624	0.26	0.15	0.04	1.75	6	101	23	197	4	63	535	43	13	61	118	40	16	6
TB-362B	Bearclaw rhyolite lava	Tlwo	42.18745	-118.32624	0.34	0.12	0.05	1.82	6	94	22	189	5	57	528	39	11	58	124	54	19	5
TB-363	Bearclaw rhyolite lava	Tlwo	42.18741	-118.32510	0.23	0.13	0.05	1.82	6	97	22	191	4	57	517	40	15	55	112	40	18	6
TB-469	Bearclaw rhyolite lava	Tlwo	42.17758	-118.34011	0.20	0.13	0.05	1.70	6	93	23	203	5	53	522	39	31	53	117	36	16	4
TB-470	Bearclaw rhyolite lava	Tlwo	42.17702	-118.34084	0.24	0.14	0.03	1.68	7	98	22	203	12	55	528	43	86	54	108	37	16	7
TB-473	Bearclaw rhyolite lava	Tlwo	42.17804	-118.31428	0.20	0.13	0.03	1.67	7	97	23	201	11	51	541	44	86	53	101	39	17	5
W7-729	Bearclaw rhyolite lava	Tlwo	42.20448	-118.33549	0.13	0.13	0.03	1.58	5	86	22	200	4	60	517	43	10	59	113	44	17	5
W7-655	Bearclaw rhyolite lava	Tlwo	42.20448	-118.33549	0.11	0.12	0.02	1.56	5	85	22	203	3	68	519	43	10	66	119	46	18	6
W7-590	Bearclaw rhyolite lava	Tlwo	42.20448	-118.33549	0.75	0.14	0.06	1.94	8	103	23	181	14	51	522	40	8	49	104	41	18	4

Post-caldera rhyolite lavas

TB-314	Red Lookout Butte rhyolite lava	Tlwy	42.32142	-118.38638	0.14	0.14	0.04	1.66	5	80	22	198	10	46	455	34	46	49	107	36	18	5
TB-563	Red Lookout Butte rhyolite lava	Tlwy	42.31757	-118.40485	0.56	0.16	0.03	1.71	16	84	24	196	16	52	454	34	74	51	114	37	16	4
TB-330	North Flagstaff Ranch rhyolite lava	Tlwy	42.19103	-118.36059	0.23	0.13	0.03	1.50	6	69	22	194	8	47	448	41	25	53	100	38	16	3
TB-331	North Flagstaff Ranch rhyolite lava	Tlwy	42.19218	-118.35779	0.04	0.12	0.01	1.06	6	71	22	178	3	41	429	37	19	43	87	33	13	6
TB-502	West Willow Butte aphyric rhyolite lava	Tlwy	42.20465	-118.31746	0.29	0.13	0.05	1.65	7	99	23	203	2	62	530	43	7	55	112	35	17	6
TB-503	West Willow Butte aphyric rhyolite lava	Tlwy	42.20698	-118.31431	0.09	0.14	0.02	1.35	5	92	23	206	7	57	539	44	27	58	114	39	17	5
TB-561	Lizard Point rhyolite lava	Tlwy	42.28884	-118.37368	0.09	0.19	0.01	1.00	7	38	25	206	14	69	487	40	81	54	116	45	18	7
TB-467	South Flagstaff Ranch rhyolite lava	Tlwy	42.18254	-118.35310	0.11	0.13	0.01	1.38	3	66	23	209	9	65	522	39	25	50	105	38	18	5
TB-468	South Flagstaff Ranch rhyolite lava	Tlwy	42.18450	-118.35268	0.10	0.12	0.01	1.23	5	79	22	201	7	62	496	40	18	51	100	38	16	6
TB-315	Buckskin Mountain rhyolite lava	Tlwy	42.27806	-118.38803	0.72	0.37	0.01	0.74	5	25	17	132	180	54	314	24	560	30	58	27	13	7
TB-316	Buckskin Mountain rhyolite lava	Tlwy	42.27248	-118.38550	0.17	0.12	0.01	0.88	8	53	20	241	7	90	330	39	30	58	101	44	29	9
TB-497	Buckskin Mountain rhyolite lava	Tlwy	42.24979	-118.38443	0.18	0.13	0.01	0.91	6	38	21	247	6	52	310	37	18	51	88	39	27	8
TB-498	Buckskin Mountain rhyolite lava	Tlwy	42.25100	-118.38515	0.21	0.12	0.03	1.36	9	73	20	249	6	60	335	38	50	57	115	50	30	9
TB-557	Buckskin Mountain rhyolite lava	Tlwy	42.25523	-118.41806	0.56	0.15	0.02	1.40	4	74	19	236	17	56	345	39	17	47	104	38	24	7
TB-558	Buckskin Mountain rhyolite lava	Tlwy	42.25534	-118.41753	0.15	0.12	0.01	1.12	5	60	19	241	4	60	328	38	10	52	96	33	26	9
TB-318	Flagstaff Butte rhyolite lava	Tlwy	42.19081	-118.38354	0.06	0.11	0.00	0.53	4	21	20	231	16	84	422	38	24	61	115	48	24	7
TB-591	Willow Butte rhyolite tuff	Tlwy	42.20094	-118.25740	0.58	0.12	0.05	1.81	10	87	21	233	23	62	414	38	20	53	110	50	29	6
TB-592	Willow Butte rhyolite lava	Tlwy	42.20618	-118.25742	0.09	0.13	0.02	1.51	5	84	21	246	8	80	413	42	17	73	119	48	27	10
TB-593	Willow Butte rhyolite lava	Tlwy	42.20687	-118.26079	1.63	0.13	0.01	1.31	9	80	22	237	20	72	362	38	30	70	134	44	26	4
TB-267	Red Mountain rhyolite lava	Tlwy	42.28585	-118.28275	0.03	0.12	0.01	1.18	5	60	22	292	2	68	387	43	7	57	113	38	26	8
TB-311	Red Mountain rhyolite lava	Tlwy	42.26521	-118.31695	0.15	0.09	0.01	0.95	8	38	20	199	9	46	338	39	14	43	92	36	19	6
TB-572	Red Mountain rhyolite lava	Tlwy	42.27900	-118.29173	0.32	0.11	0.00	0.56	4	31	21	306	5	56	403	41	12	20	40	37	30	7
TB-573	Red Mountain rhyolite lava	Tlwy	42.28692	-118.31409	0.45	0.10	0.03	1.33	7	72	20	262	14	36	352	45	15	30	68	34	29	7
TB-590	West Willow Creek rhyolite lava	Tlwy	42.24478	-118.24621	0.44	0.12	0.04	1.29	7	92	25	219	44	82	413	45	57	68	127	42	24	7
TB-321	South camp rhyolite lava	Tlwy	42.26661	-118.25176	0.44	0.15	0.02	1.07	8	31	21	184	26	52	299	28	168	34	75	40	20	7
TB-323	Campground rhyolite lava	Tlwy	42.27470	-118.26479	0.35	0.18	0.00	0.39	5	8	17	184	27	33	314	30	154	26	56	36	19	6
TB-589	East Willow Creek rhyolite lava	Tlwy	42.24952	-118.24740	0.85	0.10	0.03	1.29	5	81	19	230	101	68	358	42	11	57	118	32	21	6
TB-317	Buckskin Mountain hornblende rhyolite lava	Tlwy	42.26712	-118.38269	0.35	0.14	0.01	0.81	3	21	18	242	59	47	178	38	187	43	73	37	30	8
TB-499	Buckskin Mountain hornblende rhyolite lava	Tlwy	42.25675	-118.37917	0.61	0.13	0.03	1.08	7	49	18	231	43	55	180	36	187	35	79	35	25	7
TB-500	Buckskin Mountain hornblende rhyolite lava	Tlwy	42.25693	-118.38116	0.46	0.14	0.01	0.71	3	29	17	199	50	48	173	36	219	38	76	28	21	7

	AGV-1			P-28			GSP-1			G-2			992-15		
	Measured	Standard	% difference	Measured	Standard	% difference	Measured	Standard	% difference	Measured	Standard	% difference	Measured	Standard	% difference
Ca (wt %)	3.56	3.53	-0.01	2.11	1.96	-0.08	1.45	1.50	0.03	1.39	1.40	0.01	0.19	0.21	0.10
Ti (ppm)	6390	6293	-0.02	7638	7372	-0.04	3832	2397	-0.60	2778	2877	0.03	386.2	360	-0.07
Mn (ppm)	691	710	0.03	1679	1704	0.01	336.6	320	-0.05	224.5	232	0.03	275	310	0.11
Fe (ppm)	47670	47351	-0.01	53490	52456	-0.02	34790	30005	-0.16	18450	18605	0.01	8509	9300	0.09
Cu (ppm)	59.7	60	0.00	10.8	12	0.10	40.7	43	0.05	12.4	11	-0.13	3.4		
Zn (ppm)	88.5	88	-0.01	141.1	136	-0.04	107.2	120	0.11	89.4	86	-0.04	84.8	83	-0.02
Ga (ppm)	21.6	20	-0.08	30.4	34	0.11	22.4	22	-0.02	23.1	23	0.00	23.1		
Rb (ppm)	70	67	-0.04	56.5	64	0.12	242.8	245	0.01	176	170	-0.04	191.1	193	0.01
Sr (ppm)	670.2	660	-0.02	210.4	210	0.00	243.1	240	-0.01	479.1	478	0.00	1.1		
Y (ppm)	20.9	20	-0.04	60.3	61	0.01	24	28	0.14	13	11	-0.18	50.9	47	-0.08
Zr (ppm)	216.9	227	0.04	479.9	452	-0.06	535.2	550	0.03	322.3	309	-0.04	216.8	226	0.04
Nb (ppm)	15	15	0.00	102	98	-0.04	25.5	27	0.06	14.4	12	-0.20	66.2	67	0.01
Ba (ppm)	1256	1230	-0.02	1085	1070	-0.01	1289	1340	0.04	1899	1880	-0.01			
La (ppm)	33.2	38	0.13	74.9	71	-0.05	172.6	180	0.04	97.7	89	-0.10	27.3	35	0.22
Ce (ppm)	69.6	67	-0.04	135.2	129	-0.05	397.7	410	0.03	162.3	160	-0.01	71.5	78	0.08
Nd (ppm)	30.1	33	0.09	57.4	62	0.07	208.9	200	-0.04	55.3	55	-0.01	35.2	35	-0.01
Th (ppm)	6.5	6.5	0.00	7.9	8.8	0.10	110.1	105	-0.05	26.7	35	0.24	20.5	19.4	-0.06
U (ppm)	2	1.92	-0.04	2.1	2.5	0.16	3.6	2.4	-0.50	3.9			6.1	6.4	0.05