

ONLINE GSA DATA REPOSITORY ITEM

⁴⁰Ar/³⁹Ar TECHNIQUES

The ⁴⁰Ar/³⁹Ar age determinations were performed on crystalline groundmass separates (210-300 μm) and plagioclase and K-feldspar mineral separates using a continuous, 10W CO₂ laserprobe combined with a MAP-215/50 mass spectrometer. Sample preparation and acid leaching procedures are described in Koppers et al. (2000). Irradiated samples were loaded into Cu-planchettes designed with a variety of pans that hold up to 50 mg of material, which are then pumped within a sample chamber fitted with a ZnSe window that is transparent to the CO₂ laser wavelength. Software allows for scanning across samples in a preset pattern with a defocused beam, to evenly heat the geological material. Gas cleanup was accomplished with a series of Zr-Al getters. All ages were calculated relative to the flux monitor standard FCT-3 biotite (28.04 ± 0.18 Ma, 1σ, Renne et al., 1994) and calculated using the corrected Steiger and Jäger (1977) decay constant of $5.530 \pm 0.097 \times 10^{-10}$ 1/yr (2σ) as reported by Min et al. (2000). For a detailed description of the analytical facility and the constants used in the age calculations we refer to Koppers et al. (2003). Incremental heating plateau ages and isochron ages were calculated using the ArArCALC v2.4 software from Koppers (2002) that is available from the <http://earthref.org/tools/ararcalc.htm> website. In this paper, all errors on the ⁴⁰Ar/³⁹Ar ages are reported at the 95% confidence level (2σ), unless otherwise indicated.

⁴⁰Ar/³⁹Ar QUALITY CRITERIA

In this study we adopted the following quality criteria: (1) age plateaus should include more than three incremental heating steps and at least 50% of the total amount of ³⁹Ar released, (2) the plateau, isochron and total fusion ages should be concordant at the 95% confidence level, (3) the ⁴⁰Ar/³⁶Ar intercepts on the isochron diagrams should be concordant with the atmospheric value of

295.5 at the 95% confidence level, and (4) the mean square of weighted deviations for both the plateau ages ($\text{MSWD} = \text{SUMS}/N-1$) and isochron ages ($\text{MSWD} = \text{SUMS}/N-2$) should be sufficiently small when compared to student's t-test and F-statistic critical values for significance.

$^{40}\text{Ar}/^{39}\text{Ar}$ DATA

In Table DR1 a summary of the results of our seven new $^{40}\text{Ar}/^{39}\text{Ar}$ analyses have been listed. The age plateau diagrams are all depicted in Figure DR1, whereas the dredge locations are displayed on top of a 3D rendition of Savai'i Island in Figure DR2.

SAMPLE DESCRIPTIONS AND GEOCHEMISTRY

In Table DR2 we provide summary of the sample descriptions (Russell, 2007). In Table DR3 we list the major and trace element geochemistry and isotope ratios of the six dredge samples (Jackson et al., 2007) that also were dated using the $^{40}\text{Ar}/^{39}\text{Ar}$ technique in this study. For a detailed description of the analytical techniques used we refer to the Supplementary Table 3 in Jackson et al. (2007).

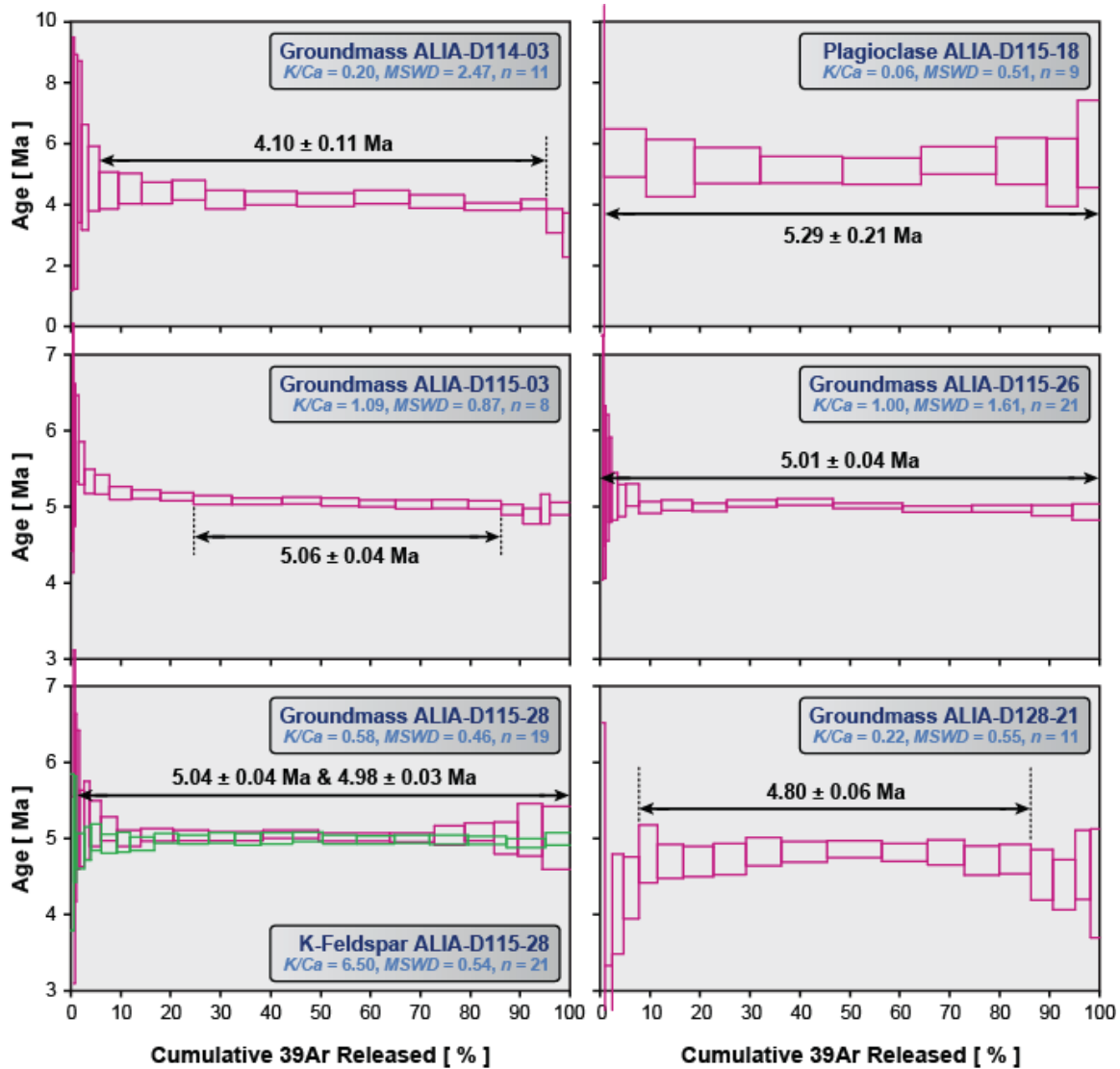


Figure DR1. New $^{40}\text{Ar}/^{39}\text{Ar}$ age spectra for the submarine Savai'i basalts. The reported ages are weighted age estimates with errors reported at the 95% confidence level, including 0.3-0.4% standard deviations in the J-value. Note that the groundmass age spectrum for sample ALIA-D115-28 was reproduced within the 95% confidence limit in a second incremental heating experiment with a K-feldspar mineral separate (green lines).

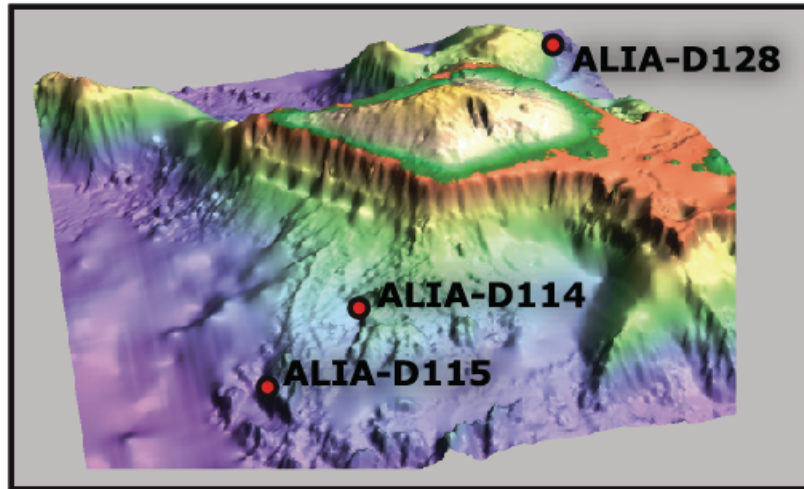


Figure DR2. 3D rendition of Savai'i Island looking from the SW with dredge locations. Visit the *Seamount Catalog* to find detailed bathymetric maps, grid files and multibeam data by using the <http://earthref.org/cgi-bin/sc.cgi?id=SMNT-137S-1725W> web link.

Sample Number	Lab Number	Lat	Lon	Depth (mbsf)	Sample Type	Age Spectrum				Total Fusion		Inverse Isochron Analyses		
						Age $\pm 2\sigma$ (Ma)	^{39}Ar (%)	K/Ca	MSWD	n	Age $\pm 2\sigma$ (Ma)	Age $\pm 2\sigma$ (Ma)	$^{40}\text{Ar}/^{36}\text{Ar}$ intercept	MSWD
ALIA-D114-03	06C3569	13°58.7'S	172°44.4'W	3,100-2,600	Groundmass	4.10 \pm 0.11	89.9	0.20	2.47	11	4.22 \pm 0.09	5.11 \pm 0.06	229.7 \pm 64.9	0.57
ALIA-D115-03	06C3034	14°05.5'S	172°56.5'W	4,100-3,200	Groundmass	5.06 \pm 0.04	61.7	1.09	0.87	8	5.10 \pm 0.04			
ALIA-D115-18	06C3069				Plagioclase	5.29 \pm 0.21	99.5	0.06	0.51	9	5.35 \pm 0.23			
ALIA-D115-26	06C3540				Groundmass	5.01 \pm 0.04	100.0	1.00	1.61	21	5.02 \pm 0.04	5.02 \pm 0.04	290.1 \pm 8.3	1.56
ALIA-D115-28	06C2898				Groundmass	5.04 \pm 0.04	99.6	0.58	0.46	19	5.07 \pm 0.05	5.03 \pm 0.04	296.2 \pm 2.7	0.47
	06C3509				K-Feldspar	4.98 \pm 0.03	100.0	6.50	0.54	21	4.97 \pm 0.03	4.99 \pm 0.05	279.1 \pm 66.0	0.55
ALIA-D128-21	06C3007	13°12.7'S	172°05.8'W	2,600-2,500	Groundmass	4.80 \pm 0.06	78.6	0.22	0.55	11	4.70 \pm 0.07	4.84 \pm 0.10	282.0 \pm 23.6	0.48

Table DR1. Summary of $^{40}\text{Ar}/^{39}\text{Ar}$ age data on dredge samples from the submarine flanks of Savai'i Island. All samples were monitored against FCT-3 biotite (28.04 ± 0.18 Ma) as calibrated by Renne et al. 1998 (1998). Reported errors on the $^{40}\text{Ar}/^{39}\text{Ar}$ ages are at the 95% confidence level including 0.3-0.4% standard deviation on the J-value. All input parameters to the calculations are published in Table 2 of Koppers et al. 2003 (2003), whereas the ArArCALC v2.4 age calculations are described in Koppers 2002 (Koppers, 2002). Detailed data sets are available in the Supplementary Materials and all ArArCALC age calculation files can be downloaded separately from the *EarthRef.org Digital Archive* (ERDA).

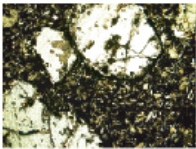
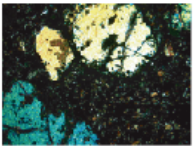
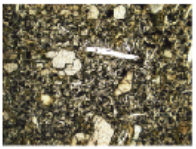
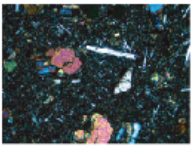
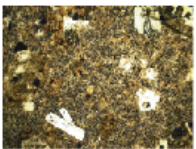
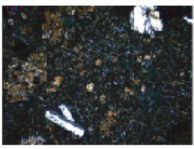
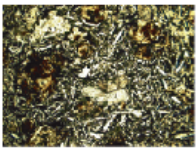
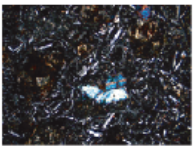
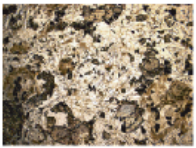
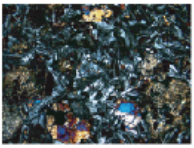
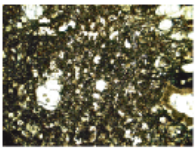
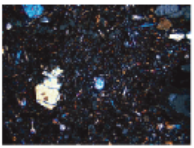
ALIA 2005 Dredge	Thin Section Photograph		Description	Material(s) Age Dated
	Plain Polarized Light	Cross Polarized Light		
D114-03			Non-vesicular picritic basalt; phenox = 20% cpx, 5% olivine; grndm = hypocrySTALLINE with 40% plg; alt = all of olivine, 5% in groundmass, 2% in cpx; other = thin Mn crust	Groundmass Leached (2X), magnet handpicked 109.6 mg
D115-03			Vesicular (1%) hawaiite; phenox = 25% cpx, 10% plg; grndm = hypocrySTALLINE with 60% plg, 10% cpx; alt = 10% in groundmass	Groundmass Leached handpicked 112.3 mg
D115-18			Vesicular (20%) trachybasalt; phenox = 5% plg, 3% cpx; grndm = holocrySTALLINE with 20% plg; alt = 10% in groundmass; other = thin Mn crust	K-Feldspar Magnet, leached handpicked 30.9 mg
D115-26			Vesicular (5%) trachybasalt; phenox = 5% plg, 3% cpx, <1% olivine; grndm = holocrySTALLINE with 95% plg and 5% cpx; alt = 3% in phenocrysts, 1% in groundmass	Groundmass Magnet, leached handpicked 103.9 mg
D115-28			Vesicular (5%) hawaiite; phenox = 5% cpx; grndm = holocrySTALLINE with 90% plg and kfs; alt = 5% in groundmass	Groundmass Magnet, leached handpicked 111.1 mg K-Feldspar Magnet, leached handpicked 64.3 mg
D128-21			Vesicular (40%) alkali basalt; phenox = 25% cpx; grndm = hypocrySTALLINE with 20% cpx, 10% plg; alt = 20% in groundmass	Groundmass Magnet, leached handpicked 103.9 mg

Table DR2. Sample descriptions and thin section pictures of Savai'i dredge samples. After Russell (2007).

Sample Number Rock Type	ALIA-D114-03 Picritic Basalt	ALIA-D115-03 Hawaiite	ALIA-D115-18 Trachybasalt	ALIA-D115-26 Trachybasalt	ALIA-D115-28 Hawaiite	ALIA-D128-21 Alkali Basalt
Latitude	13°58.7'S	14°05.5'S	14°05.5'S	14°05.5'S	14°05.5'S	13°12.7'S
Longitude	172°44.4'W	172°56.5'W	172°56.5'W	172°56.5'W	172°56.5'W	172°05.8'W
Depth Range (m)	3,100-2,600	4,100-3,200	4,100-3,200	4,100-3,200	4,100-3,200	2,600-2,500
40Ar/39Ar Age	4.10 ± 0.11 Ma	5.06 ± 0.04 Ma	5.29 ± 0.21 Ma	5.01 ± 0.04 Ma	5.04 ± 0.04 Ma 4.98 ± 0.03 Ma	4.80 ± 0.06 Ma
SiO₂	44.92	49.16	52.28	51.88	50.00	48.95
Al₂O₃	7.42	12.59	14.20	14.26	13.44	12.11
TiO₂	3.00	3.50	2.45	2.71	3.30	2.28
FeO	12.33	9.74	7.09	7.46	7.86	9.67
MnO	0.18	0.13	0.07	0.09	0.12	0.17
CaO	8.89	8.17	6.08	7.27	9.62	9.81
MgO	20.07	7.97	5.09	4.08	6.37	11.65
K₂O	0.83	3.09	4.01	3.52	2.73	1.23
Na₂O	1.55	2.85	3.64	3.50	3.15	2.12
P₂O₅	0.36	0.51	0.36	0.42	0.52	0.25
Total	99.55	97.71	95.27	95.19	97.11	98.24
Mg#	76.32	61.84	58.73	52.02	61.63	70.46
LOI	0.00	1.90	4.40	4.42	2.51	1.43
Ni (ppm)	820	222	116	106	180	265
Cr	1418	370	244	494	464	713
V	258	237	154	221	270	261
Ga	13	24	27	27	24	19
Cu	76	41	23	53	52	41
Zn	127	120	111	150	103	115
Cs	0.22	0.7	0.59	0.58	0.66	0.41
Rb	14.2	83.1	97.4	99.8	81.4	28.4
Ba	177	569	646	586	510	240
Th	3.28	7.13	10.74	10.31	8.89	4.29
U	0.63	1.63	1.84	2.1	1.77	0.72
Nb	33.64	54.12	47.48	47.73	54.31	31.26
Ta	2.31	3.68	3.17	3.23	3.61	2.17
La	28.05	53.17	66.92	59.58	61.04	32.25
Ce	60.69	104.2	130.1	118.6	119.4	66.79
Pb	2.28	7.27	11.29	8.84	11.61	4.77
Pr	7.75	11.97	15.02	14.39	13.76	8.55
Nd	32.01	48.31	55.89	55.43	52.43	34.67
Sr	374	617	511	5.28	645	363
Zr	186	305	341	320	313	179
Hf	4.8	8.02	8.86	8.26	7.88	5.02
Sm	7.06	10.69	10.66	11.24	10.46	7.5
Eu	2.22	3.14	3	3.2	3.14	2.17
Gd	6.2	9.02	8.34	9.2	9.01	6.86
Tb	0.9	1.25	1.13	1.28	1.24	1.02
Dy	4.89	6.44	5.67	6.66	6.65	5.49
Ho	0.86	1.06	0.97	1.15	1.15	1.03
Y	20.58	27.26	24.05	28.79	28.16	25.78
Er	2	2.36	2.2	2.65	2.69	2.47
Tm	0.25	0.3	0.28	0.33	0.33	0.34
Yb	1.41	1.59	1.47	1.87	1.89	1.98
Lu	0.2	0.22	0.21	0.27	0.27	0.29
Sc	29.9	19.8	15.2	19.8	24.4	28.9
87Sr/86Sr	0.705435	0.711409	0.718592	0.716394	0.709985	0.712500
143Nd/144Nd	0.512763	0.512593	0.512314	0.512389	0.512570	0.512459
206Pb/204Pb	19.322	19.011	18.957	19.009	19.034	18.963
207Pb/204Pb	15.619	15.633	15.643	15.644	15.634	15.628
208Pb/204Pb	39.475	39.347	39.399	39.452	39.419	39.273

Table DR3. Major and trace element data and isotope ratios on Savai'i dredge samples. After Jackson et al. (2007).

References

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