DATA REPOSITORY MATERIALS

1. U-Pb Geochronology: Analytical Techniques and Data Interpretation

By Richard Friedman, Pacific Centre for Isotopic and Geochemical Research,
Department of Earth and Ocean Sciences, University of British Columbia

accompanying Tucker et al., Geology and complex collapse mechanisms of the 3.72 Ma Hannegan caldera, North Cascades, Washington, USA

All sample preparation, geochemical separations, and mass spectrometry were done at the Pacific Centre for Isotopic and Geochemical Research in the Department of Earth and Ocean Sciences, University of British Columbia. Zircon and other accessory phases were separated from samples using conventional crushing, grinding, and Wilfley table techniques, followed by final concentration using heavy liquids and magnetic separations. Mineral fractions for analysis were selected based on grain quality, size, magnetic susceptibility, and morphology. All zircon fractions were air abraded prior to dissolution to minimize the effects of post-crystallization Pb-loss, using the technique of Krogh (1982). Samples were dissolved in concentrated HF and HNO_3 in the presence of a mixed $^{233\text{-}235}U$-^{205}Pb tracer for 40 hours at 240 C in PTFE or PFA microcapsules contained in high-pressure vessels (Parr bombs). Sample solutions were then dried to salts at ~125°C, rebombed and redissolved in 3.1N HCl for 12 hours at 210°C. Separation and purification of Pb and U employed ion exchange column techniques modified slightly from those described by Parrish et al. (1987). Pb and U were sequentially eluted into a single beaker and loaded together on a single Re filament using a phosphoric acid-silica gel ($SiCl_4$) emitter. Isotopic ratios were measured using a modified single collector VG-54R thermal ionization mass spectrometer equipped with an analogue Daly photomultiplier. Measurements were done in peak-switching mode on the Daly detector. U and Pb analytical blanks were in the range of <1 pg and 2-5 pg, respectively, during the course of this study. U fractionation was determined directly on individual runs using the $^{233-235}U$ tracer, and Pb isotopic ratios were corrected for fractionation of 0.37%/amu, based on replicate analyses of the NBS-981 Pb standard and the values recommended by Thirlwall (2000). All analytical errors were numerically propagated through the entire age calculation using the technique of Roddick (1987). Concordia intercept ages and associated errors were calculated using a modified version of the York-II regression model (wherein the York-II errors are multiplied by the MSWD) and the algorithm of Ludwig (1980). Interpreted U-Pb ages are based on $^{206}Pb/^{238}U$ ages corrected for initial ^{206}Pb deficit (Schärer, 1984; Parrish, 1990). Correction details are listed in the footnotes of Table DR3. All errors are quoted at the 2σ level.

2. $^{40}Ar/^{39}Ar$ Geochronology: Analytical Techniques and Data Interpretation

by Tom Ullrich, Pacific Centre for Isotopic and Geochemical Research, Department of Earth and Ocean Sciences, University of British Columbia

accompanying Tucker et al., Geology and complex collapse mechanisms of the 3.72 Ma Hannegan caldera, North Cascades, Washington, USA

Each sample was crushed and sieved to obtain fragments in the size range from 0.25 to 0.5 mm. A hand magnet was passed over the samples to remove magnetic minerals and metallic crusher fragments. The samples were washed in deionized water, rinsed, and then air-dried at room temperature. Mineral separates were handpicked, wrapped in aluminum foil and stacked in an irradiation capsule with similar-aged samples and neutron flux monitors (Fish Canyon Tuff sanidine, 28.02 Ma (Renne et al., 1998)).

The samples were irradiated on April 14, 2003 at the McMaster Nuclear Reactor in Hamilton, Ontario, for 4 MWH, with a neutron flux of approximately $3x10^{16}$ neutrons/cm^2. Analyses (n=36) of 12 neutron flux monitor positions produced errors of <1% in the J value.

The samples were analyzed on May 28 and 31, 2004, at the Noble Gas Laboratory, Pacific Centre for Isotopic and Geochemical Research, University of British Columbia, Vancouver, BC, Canada. The separates were step-heated at incrementally higher powers in the defocused beam of a 10W CO_2 laser (New Wave Research MIR10) until fused. The gas evolved from each step was analyzed by a VG5400 mass spectrometer equipped with an ion-counting electron multiplier. All measurements were corrected for total system blank, mass spectrometer sensitivity, mass discrimination, radioactive decay during and subsequent to irradiation, as well as interfering Ar from atmospheric contamination, and the irradiation of Ca, Cl and K. Details of the analyses are presented in Table DR 3. The plateau and correlation ages were calculated using Isoplot ver. 3.09 (Ludwig, 2003) and shown in Figure DR2. Errors are quoted at the 2-

sigma (95% confidence) level and are propagated from all sources except mass spectrometer sensitivity and age of the flux monitor.

References:

Krogh, T.E., 1982, Improved accuracy of U-Pb zircon ages by the creation of more concordant systems using an air abrasion technique: Geochimica et Cosmochimica Acta, v. 46, p. 637-649.

Ludwig, K.R., 1980, Calculation of uncertainties of U-Pb isotopic data: Earth and Planetary Science Letters, v. 46, p. 212-220.

Ludwig, K.R, 2003. Isoplot 3.00: A Geochronological Toolkit for Microsoft Excel: Berkeley Geochronology Center, Special Publication No. 4.

Parrish, R.R., 1990, U-Pb dating of monazite and its application to geological problems: Canadian Journal of Earth Sciences, v. 27, p. 1431-1450.

Parrish, R., Roddick, J.C., Loveridge, W.D., and Sullivan, R.W., 1987, Uranium-lead analytical techniques at the geochronology laboratory, Geological Survey of Canada: *In* Radiogenic Age and Isotopic Studies, Report 1, Geological Survey of Canada, Paper 87-2, p. 3-7.

Renne, P.R., Swisher, C.C., III, Deino, A.L., Karner, D.B., Owens, T., and DePaolo, D.J., 1998, Intercalibration of standards, absolute ages and uncertainties in 40Ar/39Ar dating: Chemical Geology, v. 145(1-2), p.117-152.

Roddick, J.C., 1987, Generalized numerical error analysis with application to geochronology and thermodynamics: Geochimica et Cosmochimica Acta, v. 51, p. 2129-2135.

Sandeman, H.A., Archibald, D.A., Grant, J.W., Villeneuve, M.E., and Ford, F.D., 1999, Characterization of the chemical composition and Ar^{40}-Ar^{39} systematics of intralaboratory standard MAC-83 biotite: Current Research - Geological Survey of Canada, Report: 1999-F, pp.13-26.

Schärer, U., 1984, The effect of ^{230}Th on young U-Pb ages: the Makula case, Himalaya: Earth and Planetary Science Letters, v. 67, p. 191-204.

Stacey, J.S., and Kramers, J.D., 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: Earth and Planetary Science Letters, v. 26, p. 207-221.

Thirlwall, M.F., 2000, Inter-laboratory and other errors in Pb isotope analyses investigated using a ^{207}Pb–^{204}Pb double spike: Chemical Geology, v. 163 p. 299–322.

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TABLE DR1. ICP-MS TRACE ELEMENT CHEMICAL DATA

Sample[†]	unit	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Ba	Th	Nb	Y	Hf	Ta	U	Pb	Rb	Cs	Sr	Sc	Zr
HC47	dike	13.93	29.12	3.66	16.10	4.05	1.35	4.25	0.70	4.40	0.90	2.45	0.36	2.25	0.36	370	2.12	5.27	23.38	3.16	0.35	0.79	3.64	40.8	1.01	522	29.6	123
HC49	dike	19.61	39.69	4.97	21.07	4.84	1.45	4.53	0.72	4.30	0.86	2.35	0.34	2.13	0.34	465	3.47	6.93	23.06	4.17	0.44	1.13	4.25	44.6	0.62	710	22.2	161
HC65	acd	20.90	40.79	4.89	20.47	4.85	1.47	4.62	0.74	4.40	0.91	2.36	0.35	2.20	0.34	617	3.45	7.83	23.65	3.98	0.52	1.24	6.78	21.6	1.47	619	18.3	153
HC18	dike	17.84	35.88	4.29	17.76	4.10	1.20	3.75	0.59	3.56	0.73	1.97	0.30	1.90	0.30	503	4.69	6.19	19.47	4.06	0.45	1.69	11.56	39.4	0.38	552	16.3	151
HC 123	Tcid	27.77	55.27	6.56	26.91	6.21	1.55	5.83	0.94	5.78	1.14	3.17	0.46	2.93	0.47	570	5.31	14.30	31.45	6.54	0.96	1.94	11.29	42.3	1.16	522	15.6	265
HC48	dike	18.52	36.31	4.46	18.71	4.36	1.27	4.06	0.65	3.88	0.81	2.16	0.32	1.99	0.32	522	3.75	6.78	21.51	4.05	0.47	1.36	6.54	44.4	0.57	609	16.5	156
HC88	acp	24.87	47.51	5.58	22.24	5.21	1.45	4.80	0.76	4.61	0.94	2.54	0.38	2.37	0.38	734	6.01	9.68	25.02	5.23	0.69	2.16	8.99	59.6	0.62	566	14.3	204
HC115	dike	26.85	53.41	6.31	25.65	5.94	1.61	5.53	0.93	5.72	1.21	3.42	0.52	3.28	0.52	639	6.44	10.53	32.62	6.36	0.73	2.30	9.22	65.0	1.49	321	14.8	250
HC17	dike	27.21	50.35	6.00	23.37	5.10	1.38	4.62	0.76	4.61	0.95	2.66	0.42	2.67	0.42	754	6.88	11.95	25.50	6.33	0.88	2.53	9.74	62.3	1.21	343	8.4	253
HC 124	Tcnm	26.28	50.25	5.61	21.51	4.76	0.98	4.29	0.73	4.47	0.91	2.68	0.40	2.63	0.42	646	11.05	11.29	25.98	6.66	0.95	3.50	9.26	97.2	1.83	305	8.3	242
HC 140	rdr	25.64	48.40	5.44	21.33	4.64	1.24	4.28	0.72	4.60	0.96	2.82	0.43	2.83	0.46	713	6.66	13.26	26.89	6.62	0.94	2.84	11.36	48.6	1.21	268	10.3	276
HC98	Δv	27.84	52.62	6.04	23.37	5.22	1.31	4.77	0.81	5.01	1.04	2.93	0.45	2.91	0.46	769	7.57	12.76	28.18	6.89	0.93	2.86	13.26	65.5	1.01	276	8.7	275
HC31	dike	24.37	43.87	4.66	16.85	3.34	0.67	2.78	0.48	3.13	0.68	2.13	0.35	2.46	0.41	835	9.20	13.57	19.27	6.75	1.09	3.63	10.94	81.7	1.05	108	4.1	264
HC113	rhg	26.33	43.98	4.47	15.18	2.91	0.51	2.42	0.42	2.60	0.55	1.66	0.27	1.90	0.31	823	10.71	11.74	16.40	4.35	1.13	3.69	13.80	82.2	1.05	84	2.2	143

Note: Units are in ppm, arranged by increasing SiO_2. Analyses were obtained by inductively coupled plasma source mass spectrometer at the GeoChemical Laboratory, Washington State University, at Pullman, Washington; principal analyst Charles Knaack.

Analytical methods are described at http://www.wsu.edu/~geology/Pages/Services/ICP.html

[†]All samples collected by Dave Tucker, 1999-2003; assisted by Tim Boyer, Kim Brown, Sue DeBari, Jill Fugate, Judy Fierstein, Wes Hildreth, Scott Linneman, Aaron Noble, Gary Petro, Stephen Slaughter, and Patty Weston. Sample UTM coordinates are listed in Table 1 in the text

TABLE DR2. U-Pb ISOTOPE DATA FOR POST CALDERA ICY PEAK AND NOOKSACK CIRQUE PLUTONS

Fraction†	Wt (mg)	U‡ (ppm)	Pb*§ (ppm)	$^{206}Pb/^{204}Pb$ #	Pb†† (pg)	^{208}Pb ‡‡ (%)	Isotopic ratios (1s,%) §§ $^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	Apparent ages (2s,Ma) §§ $^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	Th/U_z ##	*f*†††	$^{206}Pb/^{238}U_c$ ‡‡‡ (Ma)
HC-123															
Icy Peak															
A	0.380	587	0.3	60	171	19.3	0.00052 (1.4)	0.0035 (4.4)	0.04832 (3.6)	3.34 (0.09)	3.5 (0.3)	115 (163/180)	0.79	0.29	3.42
B	0.475	534	0.3	63	173	18.6	0.00052 (1.2)	0.0030 (21.7)	0.04154 (20.9)	3.33 (0.08)	3.0 (1.3)	-254 (818/1626)	0.80	0.29	3.41
C	0.558	582	0.3	48	344	19.7	0.00052 (1.5)	0.0033 (11.0)	0.04664 (10.4)	3.34 (0.10)	3.4 (0.7)	30 (434/590)	0.80	0.29	3.42
D	0.430	493	0.3	54	188	18.5	0.00052 (1.2)	0.0031 (16.7)	0.04301 (16.1)	3.34 (0.08)	3.1 (1.0)	-167 (652/1076)	0.80	0.29	3.42
HC-124															
Nooksack Cirque															
A	0.389	195	0.1	36	135	15.7	0.00051 (3.1)	0.0035 (9.8)	0.04930 (8.1)	3.27 (0.20)	3.5 (0.7)	162 (339/428)	0.62	0.20	3.36
B	0.201	196	0.1	45	47	16.6	0.00051 (2.1)	0.0036 (6.5)	0.05134 (5.4)	3.27 (0.14)	3.6 (0.5)	256 (232/270)	0.66	0.21	3.36
C	0.578	151	0.1	38	142	13.9	0.00050 (3.0)	0.0030 (10.6)	0.04403 (9.0)	3.23 (0.19)	3.1 (0.7)	-109 (392/513)	0.50	0.16	3.32
D	0.211	224	0.1	56	39	12.4	0.00049 (1.5)	0.0033 (5.2)	0.04807 (4.4)	3.18 (0.09)	3.3 (0.3)	103 (196/222)	0.46	0.15	3.27

†All zircon grains selected for analysis were strongly abraded prior to dissolution. Capital letter designation is fraction identifier. Zircons from both samples are pale pink, stubby multi-faceted to elongate euhedral grains with aspect ratios of 2-5. Many grains have clear inclusions and some tubes parallel to c-axis. No cores or zoning were visible during grain selection under a binocular microscope in ethanol.

‡U blank correction of 1pg ± 20%; U fractionation corrections were measured for each run with a double ^{233}U-^{235}U spike.

§Radiogenic Pb

#Measured ratio corrected for spike and Pb fractionation of 0.0037/amu ± 20% (Daly collector) which was determined by repeated analysis of NBS981 lead standard throughout the course of this study.

††Total common Pb in analysis based on blank isotopic composition.

‡‡Radiogenic Pb

§§Blank and common Pb corrected; procedural blanks ranged from about 2-5 pg (Pb) and <1 pg (U) throughout the course of the study. Common Pb concentrations are based on Stacey- Kramers model Pb (Stacey and Kramers 1973) at the interpreted age of the rock or the $^{207}Pb/^{206}Pb$ age of the rock.

##Model Th/U for zircon derived from radiogenic 208Pb and the age of the sample.

†††$(Th/U)_z/(Th/U)_{magma}$; magma values from whole rocks in ppm, HC-123: Th=5.31, U=1.94; HC-124: Th=11.05, U=3.50.

‡‡‡ Correction factor $=(-1/\lambda_{238})\ln[1+(f-1)(\lambda_{238}/\lambda_{230})]$, where ^{238}U decay constant, $\lambda_{238}=1.55125 \times 10^{-10}$/a and ^{230}Th decay constant, $\lambda_{230}=0.922 \times 10^{-5}$/a. These correction factors are added to uncorrected $^{206}Pb/^{238}U$ ages to yield $^{206}Pb/^{238}U_c$. Corrected values are plotted on the concordia diagram (Fig. DR2).

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TABLE DR3. $^{40}Ar/^{39}Ar$ AGES FOR SELECTED POSTCALDERA INTRUSIONS AND LAVAS

	Laser[†] Power (%)	Isotope Ratios $^{40}Ar/^{39}Ar$		$^{38}Ar/^{39}Ar$		$^{37}Ar/^{39}Ar$		$^{36}Ar/^{39}Ar$		Ca/K	Cl/K	%^{40}Ar	%^{39}Ar	$^{40}Ar^{*}/^{39}Ar_K$		Age±2σ
HC-113, biotite, run #1, J = 0.000492±0.000002; volume $^{39}Ar_K$ = 49.34 x 10^{-10}cm^3, integrated age = 5.43±1.70 Ma (2σ) 5/28/04																
	2	15850.738±0.273		9.715±0.275		0.598±0.321		50.754±0.273		1.594	0.074	92.85	0.14	1283.600±785.826		883.14±427.52
	<2.1	1673.621	0.047	1.081	0.064	0.076	0.171	5.725	0.051	0.202	0.001	99.29	1.53	11.908	66.116	10.54 ± 58.34
	<2.3	496.253	0.068	0.384	0.126	0.064	0.182	1.703	0.072	0.155	0.013	98.99	1.49	4.885	17.609	4.33 ±15.59
	<2.6	334.620	0.063	0.308	0.086	0.030	0.127	1.136	0.069	0.081	0.019	98.31	4.29	5.592	12.002	4.96 ± 10.62
	<2.9	279.678	0.037	0.274	0.042	0.019	0.267	0.952	0.041	0.052	0.019	98.68	6.43	3.640	9.224	3.23 ± 8.17
	<3.2	163.918	0.015	0.205	0.064	0.016	0.176	0.555	0.029	0.047	0.02	98.11	9.4	3.037	4.639	2.69 ± 4.11
	<3.5	97.669	0.015	0.162	0.024	0.009	0.235	0.319	0.049	0.023	0.02	94.5	13.93	5.270	4.517	4.67 ± 4.00
	<3.8	53.394	0.022	0.135	0.031	0.007	0.196	0.171	0.038	0.018	0.021	92.57	19.89	3.864	1.994	3.43 ±1.77
	<4.3	38.579	0.030	0.123	0.031	0.005	0.226	0.119	0.057	0.014	0.02	88.79	23.15	4.197	1.981	3.72 ±1.75
	<5	25.384	0.012	0.108	0.027	0.005	0.169	0.073	0.034	0.013	0.018	82.02	19.76	4.334	0.738	3.84 ± 0.65
HC-113,biotite,run #2, J =0.000492±0.000002; volume $^{39}Ar_K$ = 54.41 x 10^{-10}cm^3, integrated age = 6.79±1.62 Ma (2σ) 5/28/04																
	2	8973.935±0.137		5.473±0.148		0.502±0.187		29.284±0.138		1.477	0.006	94.61	0.2	522.178±293.707		412.52± 207.41
	2.1	1359.144	0.047	0.909	0.087	0.184	0.144	4.670	0.067	0.544	0.007	99.37	0.69	8.541	72.058	7.57± 63.69
	2.3	1814.213	0.048	1.197	0.059	0.076	0.098	6.141	0.053	0.215	0.01	98.28	1.57	31.316	51.074	27.58± 44.65
	2.5	421.151	0.025	0.378	0.067	0.042	0.151	1.437	0.037	0.116	0.023	98.71	2.62	5.332	13.615	4.73± 12.05
	2.8	510.923	0.027	0.425	0.039	0.021	0.212	1.724	0.035	0.058	0.021	97.97	5.7	10.330	14.721	9.15± 13.00
	3.1	451.547	0.030	0.384	0.055	0.027	0.142	1.495	0.036	0.083	0.021	96.12	6.18	17.483	10.268	15.45± 9.04
	3.3	245.308	0.020	0.261	0.037	0.012	0.113	0.816	0.030	0.032	0.022	96.49	9.72	8.555	6.124	7.58 ± 5.41
	3.5	83.943	0.015	0.169	0.031	0.012	0.167	0.269	0.049	0.036	0.024	92.49	11.3	6.158	3.760	5.46± 3.33
	3.7	32.029	0.013	0.130	0.031	0.007	0.129	0.095	0.047	0.019	0.023	84.31	16.76	4.813	1.276	4.27± 1.13
	3.9	20.073	0.016	0.113	0.045	0.010	0.237	0.058	0.058	0.029	0.02	80.61	12.31	3.536	0.986	3.14± 0.87
	4.3	17.751	0.017	0.105	0.049	0.013	0.205	0.047	0.048	0.04	0.019	71.98	14.36	4.540	0.643	4.03± 0.57
	5	15.704	0.025	0.100	0.039	0.011	0.237	0.040	0.053	0.037	0.018	69.21	18.59	4.464	0.678	3.96± 0.60
HC-123,biotite,run #1, J =0.000493±0.000002; volume $^{39}Ar_K$ = 82.18 x 10^{-10}cm^3, integrated age = 3.06±0.44 Ma (2σ) 5/31/04																

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2	851.493±0.029	0.671±0.082	0.100±0.226	2.836±0.045	0.274	0.03	96.51	0.74	29.843±31.734	26.35±27.82
2.2	191.896 0.028	0.332 0.051	0.051 0.111	0.668 0.037	0.151	0.044	100.68	1.86	-1.317 5.316	-1.17± 4.73
2.5	95.883 0.016	0.283 0.053	0.016 0.135	0.319 0.051	0.047	0.048	96.39	5.75	3.388 4.811	3.01± 4.27
2.8	36.825 0.015	0.234 0.037	0.011 0.172	0.117 0.051	0.034	0.046	91.69	10.47	2.970 1.701	2.64±1.51
3.2	26.939 0.028	0.232 0.041	0.006 0.239	0.082 0.044	0.016	0.046	87.44	14.35	3.287 0.970	2.92± 0.86
3.4	17.093 0.024	0.230 0.032	0.006 0.152	0.047 0.046	0.019	0.047	79.02	16.39	3.452 0.668	3.07± 0.59
3.8	11.470 0.015	0.226 0.024	0.004 0.303	0.028 0.054	0.012	0.047	69.35	27.22	3.395 0.462	3.02± 0.41
4.5	11.460 0.029	0.218 0.031	0.006 0.166	0.029 0.077	0.017	0.046	69.82	17.18	3.279 0.680	2.91± 0.60
5.5	18.458 0.022	0.206 0.064	0.017 0.104	0.052 0.096	0.05	0.042	78.64	6.05	3.606 1.464	3.20±1.30

HC-123,biotite,run #2, J =0.000493±0.000002; volume $^{39}Ar_K$ = 82.18 x $10^{-10}cm^3$, integrated age = 3.06±0.44 Ma (2σ) 5/31/04

2	712.440±0.101	0.639±0.114	0.213±0.150	2.530±0.107	0.443	0.038	102.41	0.83	-16.820±34.989	-15.02±31.38
2.3	85.700 0.033	0.241 0.124	0.075 0.086	0.287 0.082	0.196	0.04	95.08	3.3	3.960 6.911	3.52± 6.13
2.6	27.314 0.017	0.235 0.044	0.026 0.138	0.085 0.056	0.057	0.047	85.99	7.4	3.502 1.348	3.11± 1.20
3	12.800 0.021	0.226 0.031	0.014 0.142	0.034 0.110	0.033	0.047	72	14.83	3.258 1.106	2.90± 0.98
3.4	8.261 0.035	0.220 0.039	0.009 0.141	0.017 0.055	0.022	0.047	54.44	25.25	3.452 0.333	3.07± 0.30
3.8	6.388 0.048	0.231 0.043	0.006 0.122	0.011 0.075	0.012	0.049	44.05	35.43	3.298 0.347	2.93± 0.31
4.5	8.869 0.031	0.219 0.051	0.014 0.139	0.022 0.086	0.03	0.046	60.48	12.96	2.989 0.551	2.66± 0.49

HC-124,biotite,run #1, J =0.000495±0.000002; volume $^{39}Ar_K$ = 299.46 x $10^{-10}cm^3$, integrated age = 3.05±0.22 Ma (2σ) 5/31/04

2	350.464±0.037	0.401±0.058	0.046±0.227	1.196±0.044	0.147	0.038	99.05	0.74	3.278±10.149	2.93±9.05
2.1	123.799 0.026	0.233 0.080	0.037 0.144	0.430 0.056	0.106	0.032	100.18	0.62	-0.243 6.707	-0.22± 5.99
2.3	104.850 0.028	0.211 0.067	0.053 0.224	0.375 0.054	0.17	0.029	103.25	0.64	-3.343 5.389	-2.99± 4.82
2.6	44.502 0.063	0.183 0.032	0.013 0.372	0.144 0.059	0.046	0.033	93.86	4.75	2.679 3.682	2.39± 3.28
2.9	20.417 0.023	0.169 0.034	0.008 0.492	0.060 0.045	0.028	0.033	84.13	7.18	3.167 0.789	2.83± 0.70
3.2	15.633 0.015	0.161 0.023	0.008 0.176	0.042 0.037	0.029	0.032	77.52	10.33	3.442 0.447	3.07± 0.40
3.5	10.738 0.054	0.163 0.073	0.003 0.242	0.025 0.083	0.011	0.033	65.47	11.97	3.618 0.652	3.23± 0.58
3.9	7.839 0.019	0.163 0.018	0.001 1.674	0.014 0.044	0.004	0.034	51.86	19.6	3.695 0.207	3.30± 0.18
4.3	7.954 0.011	0.157 0.024	0.002 0.206	0.015 0.039	0.006	0.032	54.34	12.21	3.520 0.189	3.14± 0.17
5	7.324 0.019	0.157 0.023	0.004 0.571	0.013 0.050	0.013	0.032	50.07	14.32	3.551 0.225	3.17± 0.20
6	7.649 0.016	0.154 0.032	0.003 0.394	0.015 0.096	0.011	0.031	53.32	11.23	3.448 0.416	3.08± 0.37
8	9.057 0.012	0.153 0.020	0.006 0.607	0.020 0.066	0.018	0.031	60.37	6.4	3.415 0.387	3.05± 0.34

2007008

HC-124,biotite,run #2, J =0.000495±0.000002; volume $^{39}Ar_K$ = 198.9 x $10^{-10}cm^3$, integrated age = 3.40±0.24 Ma (2σ) 5/31/04

2	551.446±0.029	0.522±0.062	0.030±0.244	1.824±0.040	0.077 0.039	95.89	0.9	22.569±16.373	20.04±14.46
2.2	113.308 0.039	0.258 0.054	0.038 0.335	0.374 0.051	0.123 0.04	95.01	1.45	5.453 4.566	4.86± 4.07
2.5	52.784 0.034	0.204 0.052	0.009 0.272	0.166 0.056	0.025 0.037	90.72	3.84	4.749 2.963	4.24± 2.64
2.9	19.069 0.025	0.170 0.017	0.005 0.252	0.054 0.069	0.018 0.033	80.48	10.81	3.599 1.142	3.21± 1.02
3.3	11.203 0.029	0.169 0.037	0.004 0.525	0.027 0.070	0.015 0.034	66.71	14.86	3.579 0.569	3.19± 0.51
3.7	8.240 0.030	0.168 0.031	0.001 2.556	0.016 0.060	0.003 0.035	54.36	20.63	3.612 0.338	3.22± 0.30
4.1	7.169 0.029	0.163 0.027	0.003 0.508	0.012 0.071	0.008 0.034	45.57	17.61	3.702 0.307	3.30± 0.27
4.6	7.325 0.016	0.151 0.029	0.003 0.830	0.014 0.062	0.008 0.031	50.14	14.88	3.435 0.256	3.07± 0.23
5.4	7.278 0.017	0.146 0.030	0.003 0.363	0.013 0.059	0.008 0.03	48.45	12.31	3.485 0.246	3.11± 0.22
6.2	14.543 0.027	0.142 0.050	0.014 0.322	0.040 0.068	0.04 0.028	72.87	2.71	3.337 0.785	2.98± 0.70

HC-65,plagioclase, J =0.000492±0.000002; volume $^{39}Ar_K$ = 43.71 x $10^{-10}cm^3$, integrated age = 9.04±2.30 Ma (2σ) 5/31/04

2	4733.237±0.112	2.848±0.150	0.236±0.369	15.691±0.118	0.604 -0.022	96.26	0.46	185.768±188.709	157.78±153.47
2.1	845.486 0.079	0.539 0.094	0.056 0.493	2.822 0.082	0.154 0	96.92	2.53	26.184 31.635	23.09± 27.72
2.2	646.461 0.021	0.411 0.044	0.044 0.215	2.139 0.034	0.128 0	96.11	3.99	25.174 19.839	22.21±17.39
2.3	494.106 0.073	0.326 0.110	0.019 1.792	1.668 0.077	0.03 0	97.97	3.65	10.018 18.101	8.87±15.99
2.4	375.679 0.045	0.249 0.054	0.149 0.397	1.292 0.055	0.529 -0.001	99.75	3.56	0.901 12.818	0.80±11.37
2.6	372.084 0.021	0.230 0.039	0.065 0.173	1.193 0.039	0.226 -0.001	93.09	6.66	25.680 14.133	22.65±12.39
2.8	298.571 0.024	0.209 0.057	0.096 0.602	0.989 0.042	0.347 0.002	96.15	6.86	11.458 11.275	10.14± 9.95
3.2	274.721 0.028	0.182 0.063	0.161 0.668	0.876 0.036	0.606 0.001	92.56	11.85	20.406 8.320	18.02± 7.31
3.6	160.017 0.025	0.124 0.063	0.038 4.038	0.535 0.033	0.132 0.002	97.01	12.03	4.739 4.789	4.20± 4.24
4	102.045 0.017	0.092 0.036	0.174 0.142	0.338 0.039	0.656 0.003	95.98	13.41	4.042 4.164	3.58± 3.69
4.5	74.462 0.056	0.077 0.100	0.149 0.644	0.244 0.046	0.557 0.004	94.49	9.24	3.997 3.529	3.54± 3.13
5.5	75.042 0.026	0.079 0.045	0.242 0.507	0.248 0.040	0.919 0.004	95.56	15.07	3.266 3.042	2.90± 2.70
7	92.845 0.023	0.095 0.050	0.038 1.625	0.307 0.039	0.131 0.006	95.84	10.69	3.783 3.681	3.35± 3.26

HC-88, whole rock, run#1, J =0.000491±0.000002; volume $^{39}Ar_K$ = 130.96 x $10^{-10}cm^3$, integrated age = 3.68±0.47 Ma (2σ) 5/31/04

2	243.828±0.037	0.167±0.074	0.020± 0.158	0.784±0.042	0.066 0.001	93.77	2.88	15.188±7.547	13.40±6.64
2.3	96.419 0.030	0.075 0.074	0.012 0.173	0.305 0.040	0.04 0.001	92.22	11.7	7.479 2.760	6.61± 2.44
2.5	32.831 0.053	0.034 0.096	ERR	0.098 0.072	0 0	87.25	9.32	4.122 2.000	3.65±1.77

2.7	24.611	0.018	0.031	0.109	0.016	0.416	0.070	0.057	0.055	0.001	82.6	8.33	4.189	1.174	3.71±1.04
3	21.414	0.042	0.026	0.120	0.009	0.944	0.062	0.057	0.031	0	84.17	8.25	3.299	1.086	2.92±0.96
3.4	20.377	0.023	0.028	0.109	0.002	2.409	0.061	0.090	0.005	0	87.65	8.99	2.443	1.594	2.16±1.41
3.8	17.078	0.028	0.022	0.052	0.021	0.583	0.046	0.042	0.076	0	78.96	16.55	3.529	0.549	3.12± 0.49
4.2	17.334	0.020	0.023	0.125	0.002	3.530	0.050	0.069	0.004	0	83.77	12.27	2.743	1.008	2.43± 0.89
4.6	17.965	0.041	0.024	0.103	0.008	1.067	0.049	0.078	0.025	0	79.21	8.08	3.622	1.297	3.21± 1.15
5.2	19.285	0.018	0.028	0.086	0.009	0.555	0.055	0.061	0.031	0.001	84.17	7.66	2.956	0.968	2.62± 0.86
6	21.160	0.020	0.031	0.124	-0.007	1.237	0.061	0.066	0	0.001	84.86	5.96	3.090	1.180	2.74± 1.04

HC-88, whole rock, run#2, J =0.000491±0.000002; volume $^{39}Ar_K$ = 56.06 x 10^{-10} cm^3, integrated age = 4.68±1.23 Ma (2σ) 5/31/04

2	2101.357±0.063		1.297±0.081		0.159±0.160		6.943±0.069		0.269	0	95.81	0.83	87.810±87.040		76.15±73.91
2.1	122.935	0.030	0.093	0.083	0.015	0.973	0.408	0.040	0.019	0.001	95.96	7.39	4.880	3.714	4.32± 3.28
2.4	110.805	0.047	0.077	0.052	0.065	0.454	0.352	0.053	0.25	0	92.16	15.29	8.619	4.598	7.62± 4.06
2.7	140.998	0.018	0.100	0.036	0.064	0.336	0.466	0.025	0.235	0	95.91	11.38	5.708	2.768	5.05± 2.45
3.1	147.974	0.017	0.107	0.070	0.068	0.268	0.493	0.027	0.258	0	96.57	13.87	5.026	4.286	4.45± 3.79
3.5	44.167	0.042	0.039	0.140	0.152	0.218	0.143	0.056	0.607	0	93.47	13.63	2.796	2.106	2.47± 1.86
4	46.005	0.038	0.043	0.091	0.021	0.591	0.150	0.061	0.069	0	93.8	16.88	2.782	2.392	2.46± 2.12
5	28.732	0.019	0.031	0.077	0.021	0.382	0.089	0.066	0.063	0	88.39	13.02	3.188	1.697	2.82±1.50
6	34.399	0.023	0.036	0.178	0.005	6.798	0.108	0.050	0	0.001	89.14	7.7	3.516	1.507	3.11 ± 1.33

Notes: Neutron flux monitors: 24.36 Ma MAC-83 biotite (Sandeman et al., 1999); 28.02 Ma FCs (Renne et al., 1998). Isotope production ratios: $(^{40}Ar/^{39}Ar)_K$= 0.0302; $(^{37}Ar/^{39}Ar)_{Ca}$=1416.4306; $(^{36}Ar/^{39}Ar)_{Ca}$=0.3952; Ca/K=1.83$(^{37}Ar_{Ca}/^{39}Ar_K)$.

† "<" indicates step used in plateau age calculations; ">" indicates step used in inverse correlation calculations.

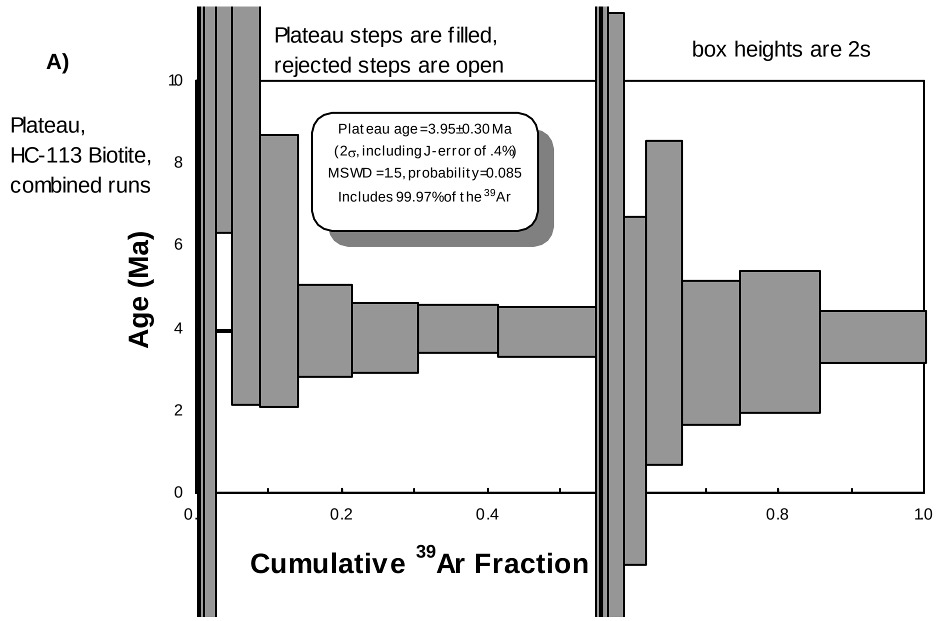
TABLE DR4. TEXTURES OF POSTCALDERA DIKES, DOMES, PLUTONS AND LAVA

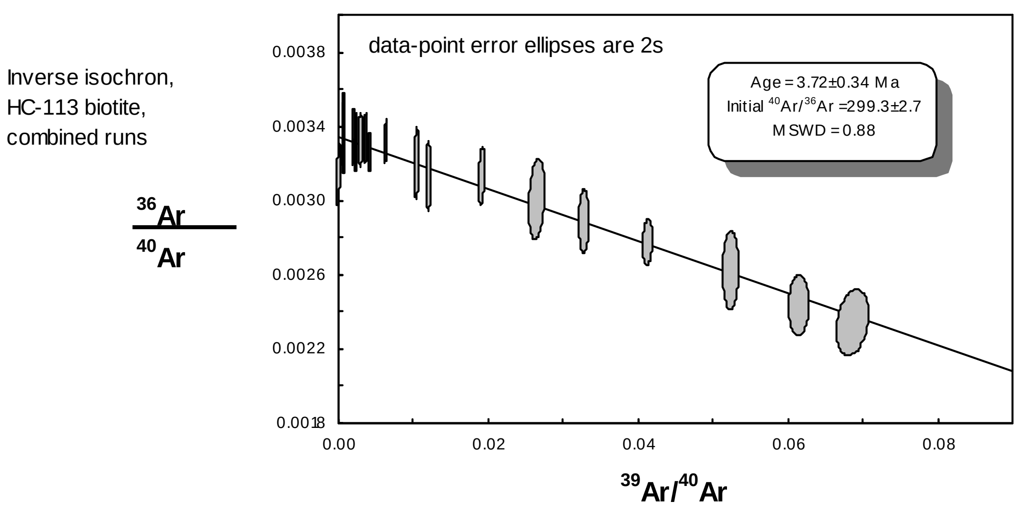
Unit and map symbol[†], if used	Sample	Phenocrysts ≥ 0.5 mm[‡]								Comment
		plag	cpx	opx	hbd	bt	al-spr	qtz	ox	
basaltic andesite dike	HC 49	28	11							cuts acd
basaltic andesite dike	HC 47	13								vesicular; cuts both ignimbrite units
acd- andesite of Cassiope Dome	HC 65	10	1	2						nonvesicular, glassy; 100-m-thick. Intrudes ignimbrite of Hannegan Peak, displaces intra-ignimbrite sedimentary rocks and ignimbrite of Ruth Mounttain
acp- andesite lava of Chilliwack Pass	HC 88	7	2	1	1					vesicles < 1 mm
hornblende andesite dike	HC 135	34		1	1	2				holocrystalline; crosscuts southern ring fault and ignimbrite of Ruth Mountain
rhyolite dike	HC 31	12			3					fills ring fault on northeast; nonvesicular
rhg- rhyolite of Hells Gorge	HC 113	11			3	1				100 x 150 m flow-banded pod intruding ignimbrite of Hannegan Peak
Tcid- Icy Peak pluton (Tabor et al., 2003)	HC 123	52 + apatite + zircon	3		1	12	25	1	2	equigranular and medium-grained (2-3 mm); intrudes ignimbrite of Ruth Mountain
Tcnm- Nooksack Cirque pluton, (Tabor et al., 2003)	HC 124	37 + apatite + zircon			5	5	39	14	1	intrudes Icy Peak pluton

[†]See Figure 3 and text for further descriptions.
[‡] Thin section point counts; values are volume %; plag = plagioclase, cpx = clinopyroxene, opx = orthopyroxene, hbd = hornblende, bt = biotite, al-spar = alkali feldspar, qtz = quartz, apt = apatite, chl = cholorite, zr = zircon, ox = oxides; all samples have 1-17% chlorite

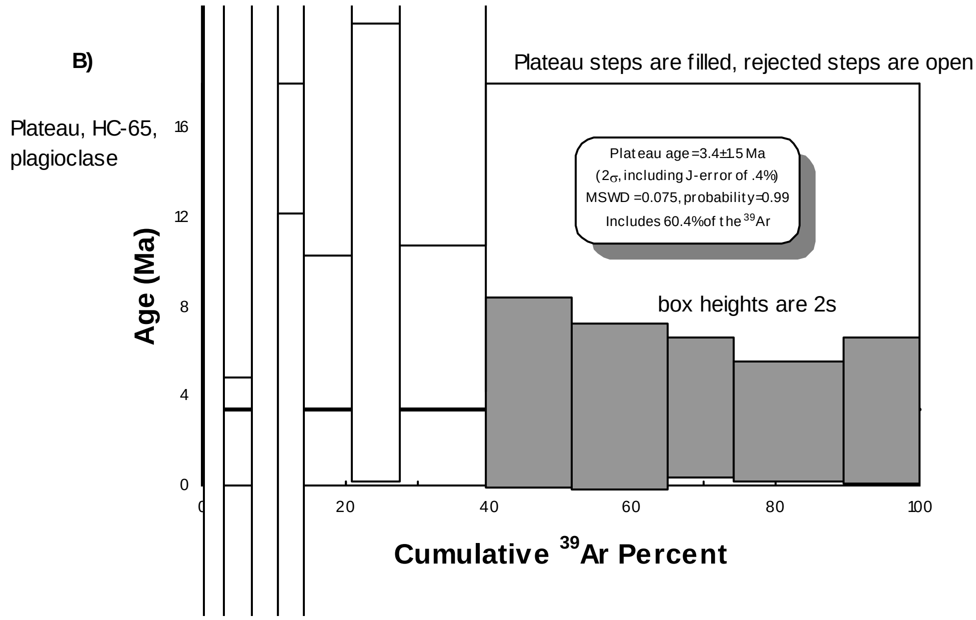
Figure DR1. $^{39}Ar/^{40}Ar$ plateaus and isochrons for dated postcaldera Hannegan Volcanics (Table 3). A) Biotite from the rhyolite of Hells Gorge (map unit rhg), a pod intruding the ignimbrite of Hannegan Peak; B) Plagioclase from the andesite of Cassiope Dome (map unit acd); C) Whole-rock from one of the lava flows in the andesite of Chilliwack Pass (map unit acp); D) biotite from the Icy Peak pluton (map unit Tcid); E) biotite from the Nooksack Cirque pluton (map unit Tcnm).

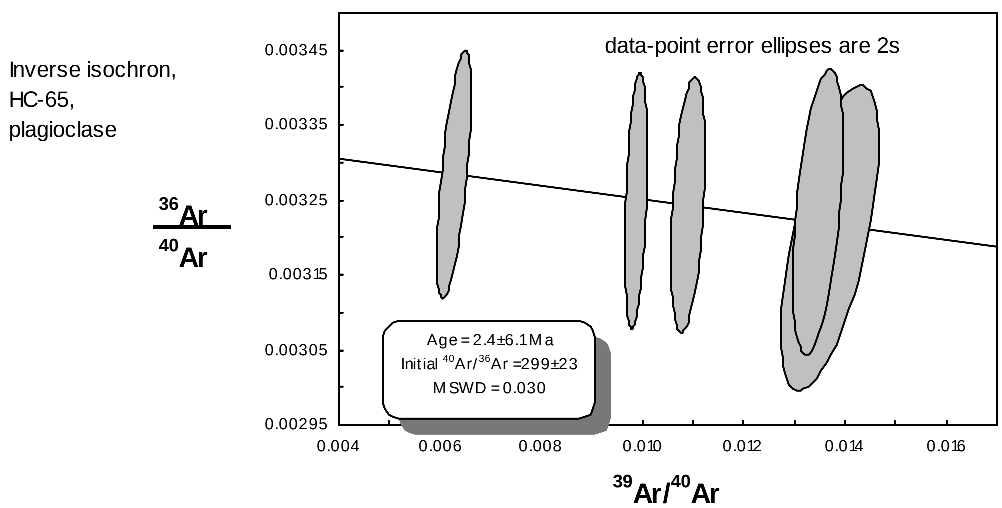
Figure DR2. Uranium-lead concordia plot for Icy Peak and Nooksack Cirque pluton zircon separates.





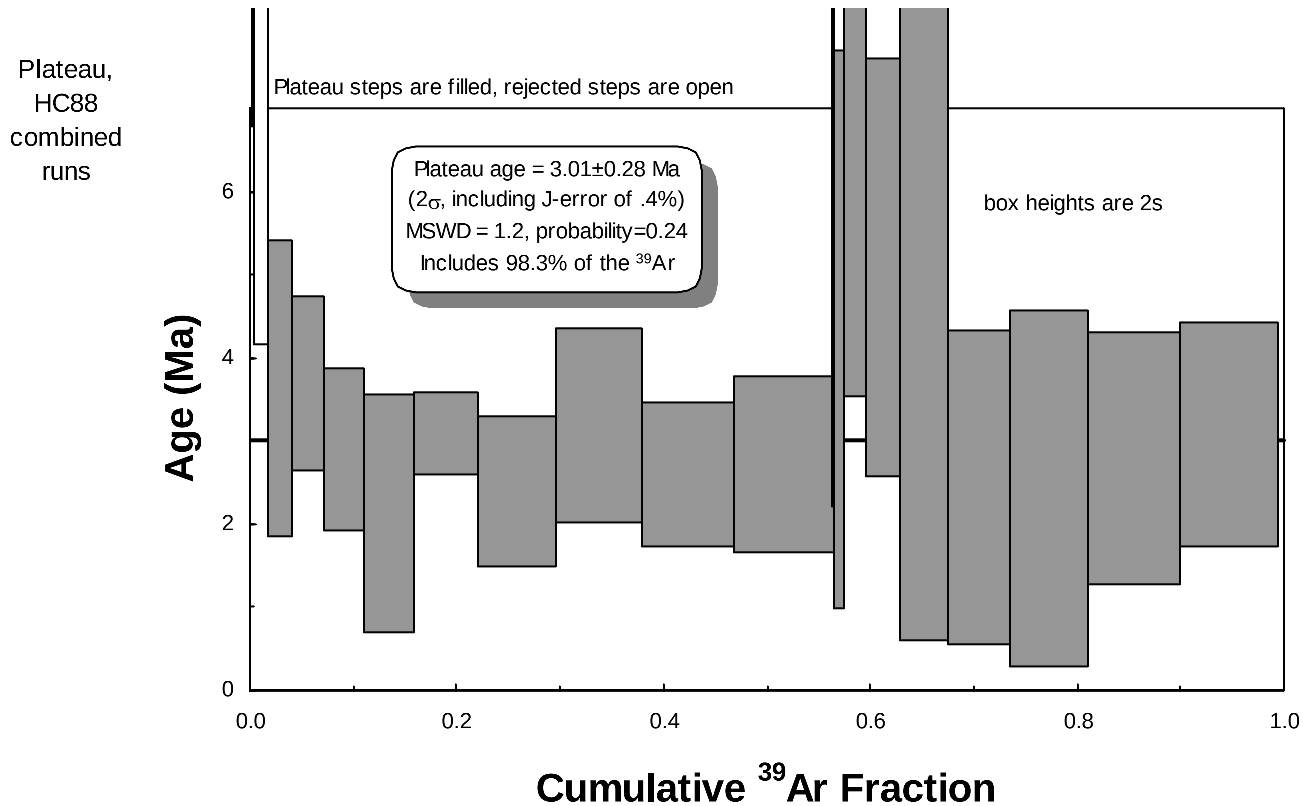
Tucker Fig DR1A

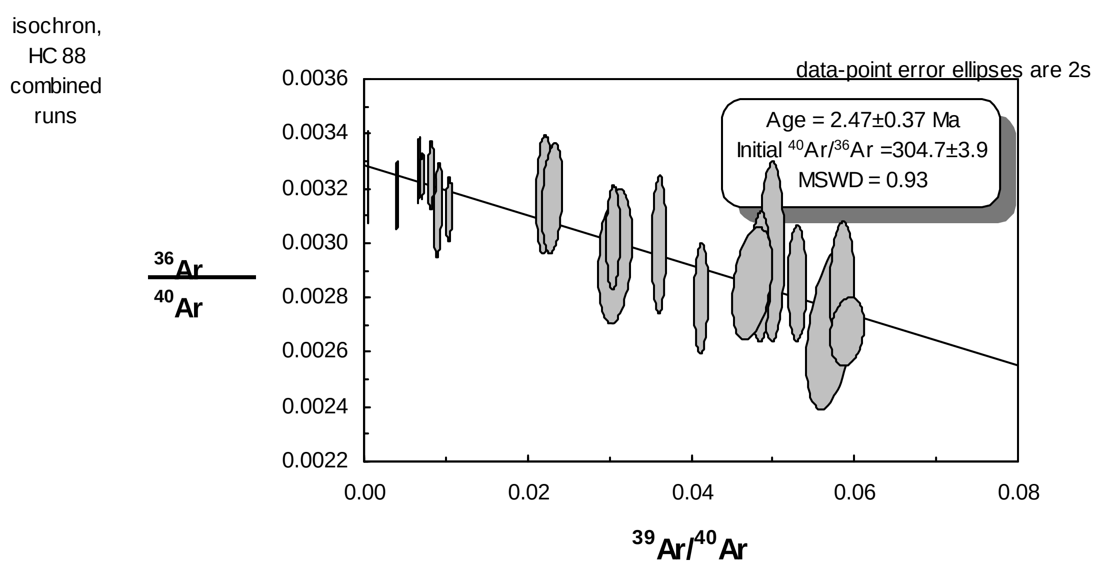




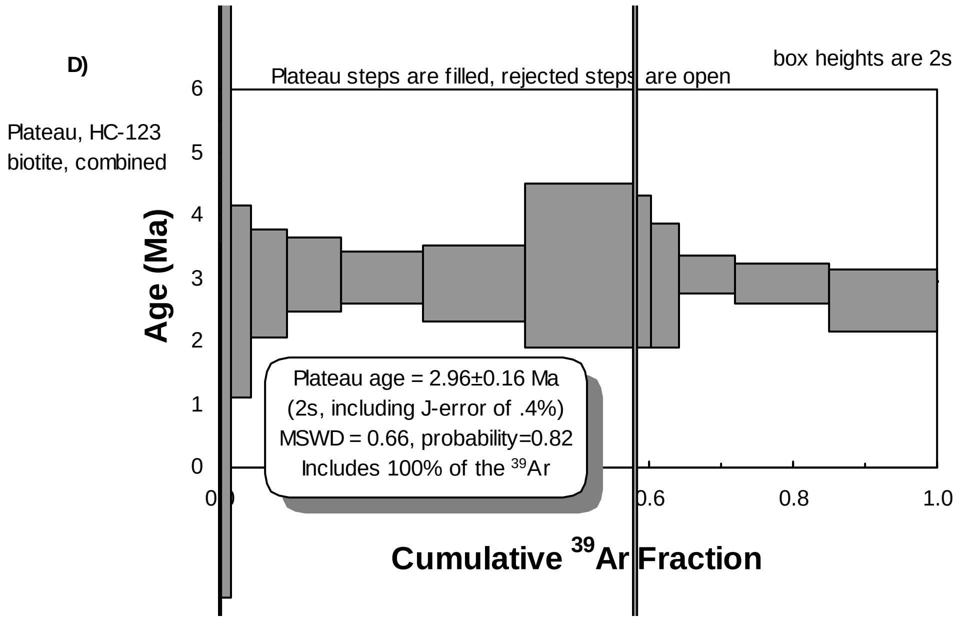
Tucker Fig. DR1B

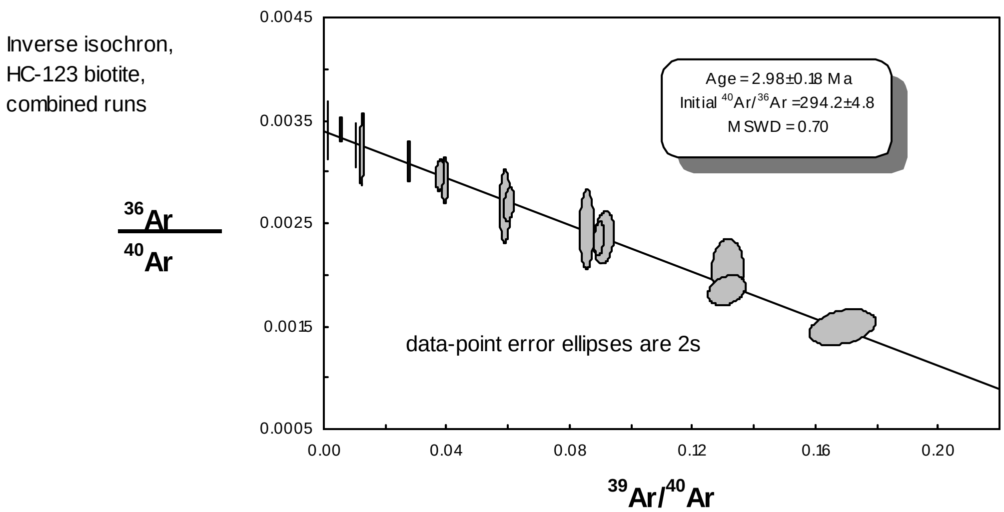
C)



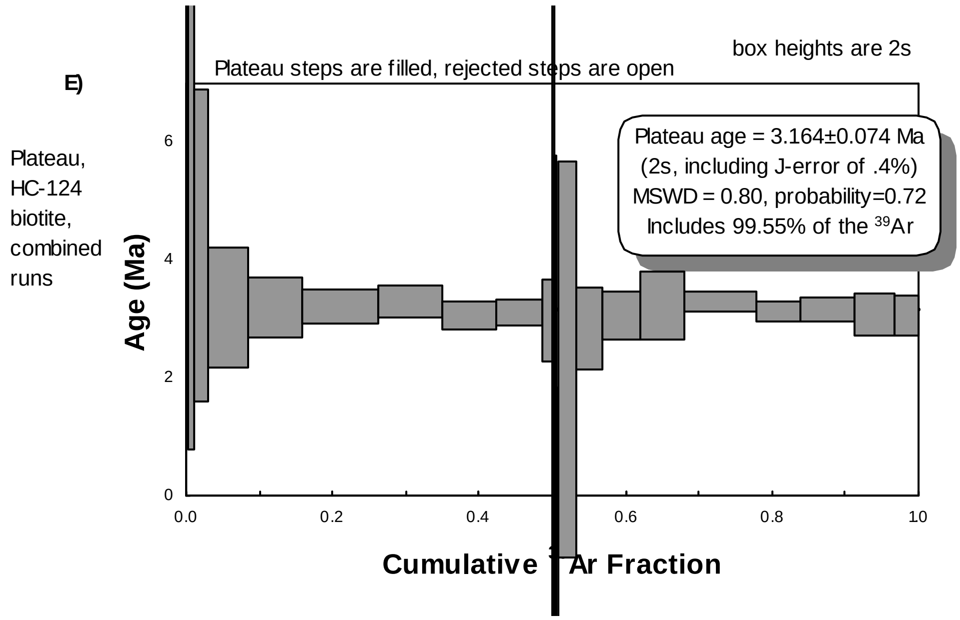


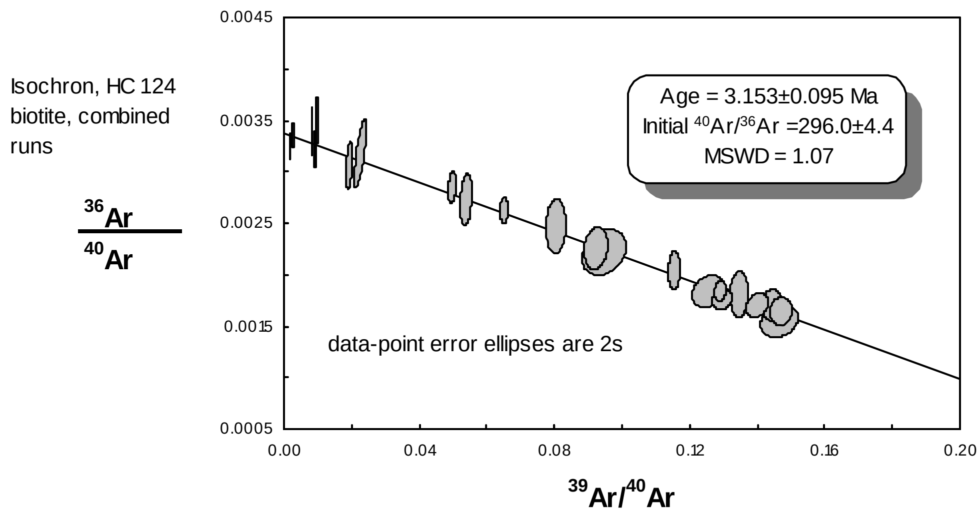
Tucker Fig DR1C





Tucker Fig. DR1D





Tucker Fig DR1E

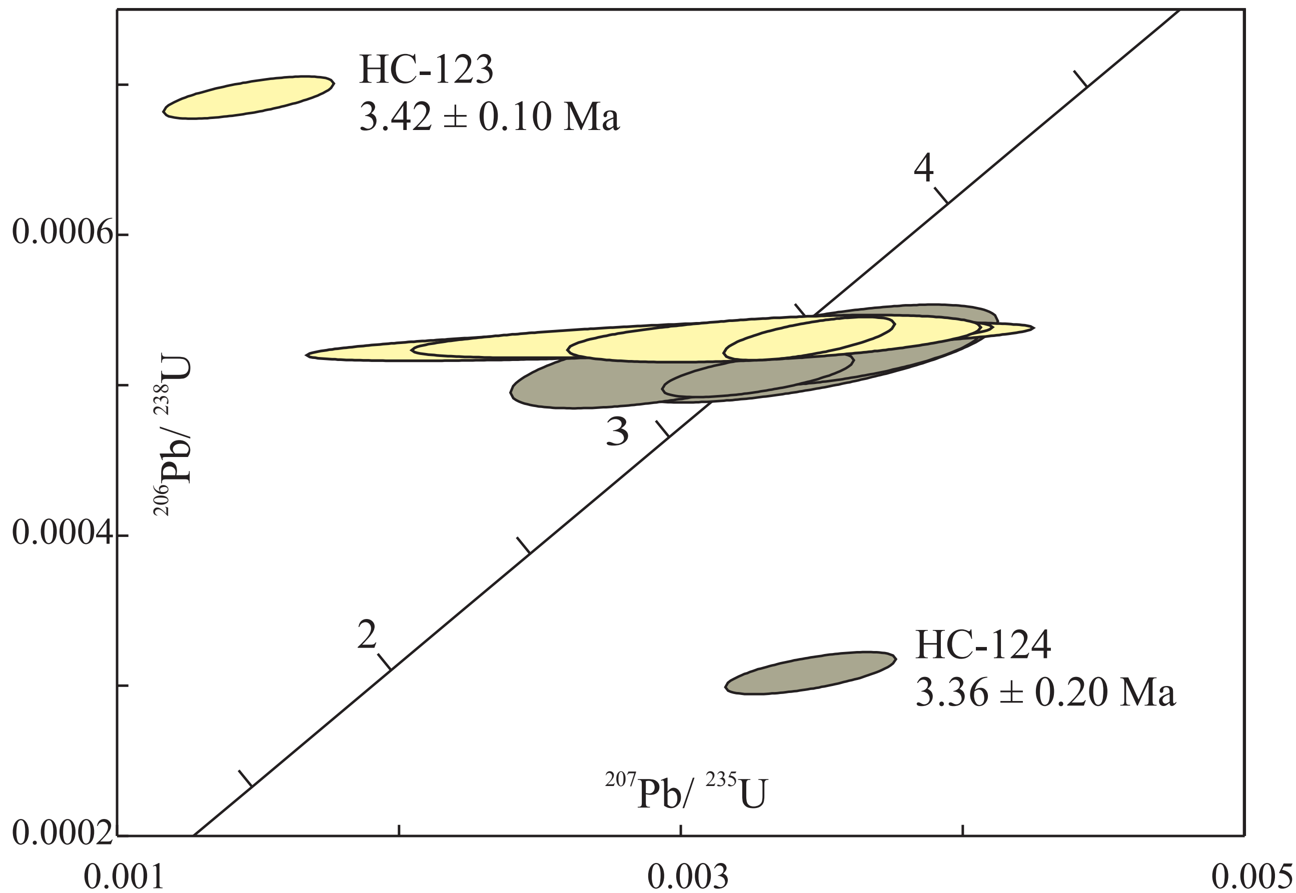

HC-123
3.42 ± 0.10 Ma
HC-124
3.36 ± 0.20 Ma
4
3
2
0.0006
0.0004
0.0002
0.001
0.003
0.005
206Pb/ 238U
207Pb/ 235U

Figure DR2