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Timing of arc construction and metamorphism in the Slate Creek Complex, northern Sierra Nevada, California, USA

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DATA REPOSITORY: SAMPLE DESCRIPTIONS AND $^{40}Ar/^{39}Ar$ ISOTOPIC RESULTS

Amphiboles were separated from eight rocks collected at seven localities in and adjacent to the Slate Creek Complex (SCC), and were used for $^{40}Ar/^{39}Ar$ geochronology to constrain the timing of volcanism and metamorphism of the SCC (Table DR-1). Two samples of relict volcanic hornblende were analyzed to determine the age of volcanism in the Lexington Hill volcanics. Amphiboles from a massive metadiorite, foliated metadiorite, and foliated metagabbro were analyzed in order to evaluate the age of metamorphic crystallization or cooling and to assess the effect of dynamic *vs.* static metamorphic crystallization on argon loss. Hornblende from the Cascade pluton was analyzed to determine an igneous cooling age for this batholith. Two hornblende separates from unmetamorphosed dikes were analyzed to evaluate ages of rapid cooling of dikes injected into the SCC.

Petrographic Descriptions

Relict volcanic hornblende (strictly, Mg-hastingsite; Tables DR-2 and DR-3; Fig. DR-1) was separated from two samples (F94-20 and F94-23) of subgreenschist to lowermost greenschist facies tuffs near the base of the Lexington Hill volcanics, the youngest unit in the SCC. Sample F94-20 is a weakly-foliated hornblende-plagioclase crystal tuff with minor lapilli-sized lithic fragments of volcanic origin. Textural domains include fine-grained matrix, relict plagioclase phenocrysts, relict hornblende phenocrysts, and veins. The matrix is composed of a fine-grained assemblage of quartz, albite, phengite, chlorite, tremolitic amphibole, and epidote with minor titanite, apatite, and opaque. The matrix is cut by rare veins composed predominantly of chlorite and/or epidote. Volcanic plagioclase is replaced by aggregates of sericite, epidote, and albite. Relict hornblende consists of euhedral prismatic crystals with high relief and tan to olive-green pleochroism (Fig. DR-2A). Prisms up to 1 mm long have length to width ratios of approximately 5:1. Some of the phenocrysts are weakly fractured and exhibit minor alteration to chlorite. Epitaxial overgrowths of acicular actinolite are common, and quartz-rich pressure shadows occur adjacent to some hornblende phenocrysts.

Sample F94-23 also is a massive hornblende-plagioclase crystal tuff. This sample was collected near the base of the Lexington Hill volcanics approximately 200 meters stratigraphically above F94-20. Textural domains in F94-23 consist of matrix, relict plagioclase and hornblende phenocrysts, and thin veinlets of quartz. The matrix consists of fine-grained quartz, albite, phengite, and epidote, with minor chlorite, titanite, and opaques. Plagioclase is replaced completely by aggregates of sausserite, albite, and fine-grained quartz. Hornblende phenocrysts exhibit euhedral crystal margins, prismatic form, and olive-green pleochroism, but are coarser grained and more extensively fractured than the hornblende in F94-20 (Fig. DR-2). Epidote, actinolite, chlorite, and titanite are common in fractures within the hornblende phenocrysts.

Amphiboles were separated from massive dioritic (F94-13), foliated dioritic (F92-117), and foliated gabbroic (F92-36) samples from the Slate Creek metaplutonic unit. Whole-rock X-ray fluorescence (XRF) analyses of (XRAL Laboratories, Don Mills, Ont., Canada) indicate SiO_2 concentrations of approximately 42.5 wt. % in F92-36 and 57.1 wt. % in F94-13 (Fagan, 1997). No XRF analysis was obtained for F94-117, but estimated modal abundances indicate a dioritic composition intermediate between F92-36 and F94-13. Quartz, feldspar, amphibole, epidote, chlorite, titanite, sericite, and opaques are common to all three samples. The only feldspar identified in F94-13 is albite; both albite and oligoclase are present in F92-36 and F94-117.

Multiple textural and compositional varieties of amphibole are present in the metaplutonic samples. Compositional varieties of amphibole include Mg-hornblende in all three samples, actinolite in F94-13, and pargasite in F92-36 (Tables DR-2 and DR-3; Fig. DR-1). Textural varieties of amphibole include coarse crystals (250 μm across or greater) with equant to stubby (length:width no greater than 5:1) prismatic form, and finer crystals (typically 50 μm across) with more elongate (length:width commonly 10:1) tapered to acicular form (Fig. DR-2C, D). These two textural varieties of amphibole form two distinct populations in F94-13, in which fine elongate amphiboles commonly protrude from, and coalesce to form serrated margins on, the coarse equant amphiboles. The elongate amphibole tends to be more Si-rich/Al-poor than the equant amphibole, but both textural varieties have similar hornblendic compositions (Fig. DR-1). Actinolite (Fig. DR-1) occurs in irregular seams and pockets within the equant hornblende, and comprises a minor fraction (< 5%) of the amphibole in F94- 13.

Coarse, equant and fine, elongate amphiboles are present in F92-36 and F94-117, but many amphiboles in these samples have textures intermediate between the two extremes. The amphiboles in F94-117 are slightly more tschermakitic than the F94-13 hornblendes, but exhibit the same intra-sample correspondence between texture and morphology: namely, elongate amphibole tends to be Si-rich and Al-poor relative to the equant amphibole (Fig. DR-1). Unlike F94-13, no actinolite was identified in F94-117. In F92-36, most of the coarse equant amphibole is pargasite identical in composition to the fine elongate amphiboles (Fig. DR-1). Some minor patches of Mg-hornblende (Fig. DR-1) occur within the interiors of coarse equant amphiboles in F92-36.

The three metaplutonic samples have undergone different extents of deformation during metamorphism. Relict plutonic textures are preserved best in F94-13, which is massive, has a high ratio of equant:elongate amphibole, and is characterized by tabular feldspar with variable concentrations of sericite and granular epidote. Sample F92-36 exhibits gneissic foliation with layers rich in amphibole and chlorite alternating with layers rich in sausseritized feldspar. The original plagioclase has been altered to aggregates of epidote and sericite with some albite and oligoclase. Most of the amphibole in F92-36 consists of the elongate variety, although some equant amphibole is also present (Fig. DR-2C). The compositional layering in F92-36 may reflect original cumulate layering, but if so, cumulus/intercumulus textures between minerals have been totally destroyed during metamorphism. Sample F94-117 has a moderate foliation defined by parallel orientation of amphibole. The original igneous feldspar was replaced completely by clear oligoclase and cloudy albite with some sericite. Both coarse and fine textural varieties of amphibole are common.

One amphibole separate was collected from a sample (F94-10) of granodiorite from the cross-cutting Cascade pluton. The sample exhibits a moderate foliation defined by parallel orientation of igneous biotite and hornblende. Equant quartz and tabular plagioclase, occasionally with sausseritized cores, are the most abundant felsic minerals. Alkali feldspar occurs as individual crystals and in myrmekitic intergrowths with quartz. Epidote and titanite occur in trace amounts, and the coarse grain size of titanite is distinctive, both in thin section and outcrop. Brown biotite and blue-green amphibole comprise the mafic phases. Amphibole occurs as subhedral prisms up to 1 mm long with typical length:width ratios of 5:2 (Fig. DR-2E) and Mg-hornblende composition (Table DR-3; Fig. DR-1).

Two amphibole separates were collected from dikes that cross-cut units of the Slate Creek Complex. F92-46 is from a dike that cross-cuts metadiorite of the Slate Creek metaplutonic unit. The interior of the dike consists of hornblende and clinopyroxene phenocrysts in a groundmass consisting of feldspar and hornblende with minor opaque sulfides. Several phenocrysts in the chilled margin have been altered to chlorite. Chlorite and epidote-rich aggregates also occur in the dike interior, suggesting a patchy, incomplete alteration pattern. Amphibole in F92-46 is euhedral pargasite (Table DR-3; Fig. DR-1) with elongate (length:width of approximately 10:1) prismatic to gently tapered prismatic form and brown pleochroism. Tiny epitaxial overgrowths of actinolite are rare (Fig. DR-1).

F94-54 is from a hornblende-phyric dike that cross-cuts clastic metasedimentary rocks in the Gold Run formation. Hornblende (Mg-hastingsite; see Table DR-3 and Fig. DR-1) is the sole phenocryst in this dike. Hornblende also occurs in the matrix, along with plagioclase, quartz, and opaques. Minor concentrations of chlorite, titanite, and carbonate appear to be secondary. Amphibole in this sample exhibits brown pleochroism and euhedral elongate prismatic crystal form (Fig. DR-2F). Length to width ratios range as high as 20:1. Patchy replacement to chlorite occupies up to approximately 3% of some amphibole prisms.

Electron Microprobe Analytical Methods

Amphibole compositions were determined by wavelength dispersive analyses on Cameca SX-50 electron microprobes at the University of Calfornia at Davis (UCD) and the University of Hawaii at Manoa (UH). Analyses were normalized to 23 oxygen with site-assignments and ferrous:ferric iron ratios determined by normalization of all cations less Na, K, and Ca to 13 (13eNKC), all cations less K to 15 (15eK), or all cations less Na and K to 15 (15eNK) (Leake and others, 1997). Metamorphic amphiboles were normalized to either 13eNKC or 15eK in accordance with the criteria of Laird and Albee (Laird and Albee, 1981); similar normalization of some of the igneous amphibole analyses resulted in suspiciously high ferric iron concentrations, thus all the igneous amphiboles were normalized to 15eNK.

Analyses were collected with a 15 keV accelerating voltage, 10 nanoamp current, and 1 micron spot size with well characterized oxide and silicate standards on both electron microprobes. Manufacturer supplied ZAF (UCD) and PAP (UH) programs were used to correct for interferences. Peak and background counting times, along with lower limits of detection and relative counting errors for both microprobes are listed in Table DR-4. The tabulated detection limits are twice the statistical lower limits of detection. Longer counting times for the UH analyses resulted in a small reduction in counting error for most elements; counting errors and detection limits for F and Na were significantly better at UH because the PC0 diffracting crystal resulted in higher count rates than the TAP crystal used at UCD. Interferences of Fe Lα peaks with the F Kα peak in data from the PC0 diffracting crystal were calibrated and calculated using CAMECA software.

Four compositionally distinct types of amphibole in three thin sections from the SCC were analyzed at both UCD and UH to assess reproducibility of data collected on the two microprobes. Between 5 and 95 analyses were collected from each of the four varieties of amphibole at both laboratories, and the mean results compared. Mean atoms per formula unit (apfu) of *all* elements, including Fe^{2+} and Fe^{3+}, from the four replicate analyses at UH are within 2 standard deviations of the means determined at UCD (using the UCD standard deviations). The standard deviations at UH are generally lower than the UCD standard deviations, probably as a consequence of fewer analyses and a more incomplete sampling of compositional heterogeneity within samples. Still, 96%, or all but two (one Na and one Fe^{3+} value), of the UCD mean apfu from the four replicate analyses fall within two UH standard deviations of the mean UH apfu.

In terms of absolute concentration, for elements present in concentrations less than 0.5 apfu, means from the UH microprobe duplicate the UCD means to within 0.02 apfu. For elements (including $Fe^T = Fe^{2+} + Fe^{3+}$) present in concentrations greater than 0.5 apfu, mean results from the two microprobes are within 0.08 apfu for all paramaters except for one Fe^T and two Si analyses. The three exceptions include a discrepancy of 0.09 apfu (6.5% relative) in one replicate analysis of Fe^T, and discrepancies of 0.13 and 0.10 apfu (1.7% and 1.3% relative) in two replicate analyses of Si. Estimates of ferrous and ferric iron reflect errors in analyses of all elements, and show a wider range of mismatch between results collected on the two microprobes. The amphibole analyses at UH yield mean ferric and ferrous iron values that are typically within 0.15 apfu of the means determined at UCD.

$^{40}Ar/^{39}Ar$ Isotopic Results

The amphibole separates were analyzed by step heating in a resistance furnace using procedures described in (Hacker, et al., 1996). Results for each heating increment are documented in Table DR-5. Step-heating profiles are presented in the text.

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TABLE DR-1. SAMPLES COLLECTED FOR $^{40}Ar/^{39}Ar$ ANALYSES

sample	latitude	longitude	7.5' quadrangle	geologic unit	outcrop description	lithology
F92-36	39°36'49"	121°03'11"	Strawberry Valley	Slate Creek complex metaplutonic rocks.	Stream polished right bank of Slate Creek 300 meters downstream from tailings dam.	Well-foliated metagabbro with quartz and epidote veins. Foliation defined by amphibole orientation, and amphibole vs. epidote (replacing feldspar)-rich compositional layering. Epidote-amphibolite facies.
F92-46	39°36'54"	121°03'04"	Strawberry Valley	Dike intrusive into Slate Creek complex metaplutonic rocks.	Stream polished right bank of Slate Creek at base of tailings dam.	Hornblende-clinopyroxene-phyric dike intrusive into massive metadiorite Well developed chilled margin. Igneous.
F94-10	39°34'50"	121°06'46"	Strawberry Valley	Cascade pluton. Late-stage cross-cutting pluton.	Road cut adjacent to spillway at Sly Creek Reservoir Dam.	Moderately to well foliated coarse biotite-hornblende-granodiorite with coarse-grained epidote and titanite. Igneous.
F94-13	39°36'54"	121°03'04"	Strawberry Valley	Slate Creek complex metaplutonic rocks.	Same as F92-46.	Massive metadiorite with salt-and-pepper texture. Epidote-amphibolite facies.
F94-20	39°43'32"	121°01'37"	American House	Slate Creek complex Lexington Hill volcanics.	Stream polished right bank of South Fork Feather River.	Massive metamorphosed hornblende-plagioclase lapilli tuff. Lowermost greenschist facies.
F94-23	39°43'30"	121°01'26"	American House	Slate Creek complex Lexington Hill volcanics.	Stream polished right bank of South Fork Feather River.	Massive metamorphosed hornblende-plagioclase crystal tuff. Lowermost greenschist facies.
F94-54	39°38'16"	121°01'48"	American House	Dike intusive into Slate Creek complex Gold Run formation.	Stream polished outcrop on right bank of Slate Creek.	Hornblende-phyric dike with well-developed chilled margin, intrusive into fine metasandstone and metasiltstone. Igneous.
F94-117	39°38'46"	121°03'55"	American House	Slate Creek complex metaplutonic rocks.	Stream polished left bank of Lost Creek.	Moderately-foliated metadiorite. Foliation defined by parallel orientation of amphibole. Epidote-amphibolite facies.

TABLE DR-2. REPRESENTATIVE ELECTRON MICROPROBE ANALYSES OF AMPHIBOLES

Sample	F92-36			F92-46		F94-10	F94-13		
Rock type	foliated metagabbro			mafic dike		grano-diorite	massive metadiorite		
Amphibole type	equant	equant Al-poor	elongate	igneous	epitaxial	plutonic	equant	equant Al-poor	elongate
Laboratory	UH	UH	UH	UH	UCD	UCD	UH	UH	UH
Normalization	13eNKC	13eNKC	13eNKC	15eNK	15eK	15eNK	13eNKC	13eNKC	13eNKC
SiO_2	39.68	46.10	39.71	42.29	54.49	46.24	48.44	54.11	48.72
TiO_2	0.47	0.70	0.57	2.30	<0.16	0.87	1.01	0.31	0.23
Al_2O_3	17.45	8.75	18.02	12.56	1.07	8.64	6.71	2.24	7.76
Cr_2O_3	<0.17	<0.17	<0.17	<0.17	<0.18	<0.18	0.17	<0.17	<0.17
FeO	16.71	13.72	17.00	8.21	12.07	16.33	14.61	11.2	14.74
MnO	0.43	0.43	0.41	<0.12	0.34	0.56	0.52	0.40	0.31
MgO	8.20	12.96	7.73	16.53	16.65	12.62	13.73	17.10	12.82
CaO	11.29	11.31	11.13	12.03	11.92	11.45	11.14	12.17	11.78
Na_2O	2.99	2.40	2.94	2.51	0.20	1.08	1.13	0.33	0.95
K_2O	0.51	0.08	0.53	0.79	<0.07	0.70	0.30	0.12	0.16
F	0.17	<0.12	<0.12	0.32	<0.58	<0.58	<0.12	<0.12	<0.12
Cl	<0.17	<0.17	<0.17	<0.17	<0.08	<0.08	0.21	<0.17	<0.17
Sum	97.9	96.45	98.04	97.54	96.74	98.49	97.97	97.98	97.47
"Excess O"	0.07	B.D.	B.D.	0.13	B.D.	B.D.	0.05	B.D.	B.D.
Sum	97.83	96.45	98.04	97.41	96.74	98.49	97.92	97.98	97.47
H_2O	1.91	2.01	2.00	1.90	2.08	2.03	1.99	2.10	2.05
Sum	99.74	98.46	100.04	99.31	98.82	100.52	99.91	100.08	99.52
Cations normalized to 23 oxygen									
Si	5.92	6.80	5.90	6.15	7.84	6.78	6.97	7.63	7.05
Al^{IV}	2.08	1.20	2.10	1.85	0.16	1.22	1.03	0.37	0.95
Fe^{3+IV}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Al^{VI}	0.99	0.32	1.06	0.30	0.03	0.27	0.11	0.00	0.38
Fe^{3+VI}	0.42	0.44	0.42	0.20	0.16	0.32	0.88	0.51	0.56
Ti	0.05	0.08	0.06	0.25	B.D.	0.10	0.11	0.03	0.02
Cr	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.	0.02	B.D.	B.D.
Mg	1.82	2.85	1.71	3.58	3.57	2.76	2.94	3.60	2.77
Fe^{2+VI}	1.66	1.25	1.69	0.67	1.23	1.56	0.87	0.82	1.22
Mn^{VI}	0.05	0.05	0.05	B.D.	0.00	0.00	0.06	0.05	0.04
Sum	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Fe^{2+M4}	0.00	0.00	0.00	0.13	0.06	0.13	0.00	0.00	0.00
Mn^{M4}	0.00	0.00	0.00	B.D.	0.04	0.07	0.00	0.00	0.00
Ca	1.80	1.79	1.77	1.87	1.84	1.80	1.72	1.84	1.83
Na^{M4}	0.20	0.21	0.23	0.00	0.06	0.00	0.28	0.09	0.17
Sum	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.93	2.00
Na^{A}	0.67	0.47	0.62	0.71	0.00	0.31	0.03	0.00	0.09
K	0.10	0.02	0.10	0.15	0.00	0.13	0.06	0.02	0.03
Sum	0.77	0.49	0.72	0.85	0.00	0.44	0.09	0.02	0.12
F	0.08	B.D.	B.D.	0.15	B.D.	B.D.	B.D.	B.D.	B.D.
Cl	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.	0.05	B.D.	B.D.
Cations	15.77	15.49	15.72	15.85	15.00	15.44	15.09	14.95	15.12
Mg/(Mg+Fe)	0.52	0.69	0.50	0.82	0.73	0.62	0.77	0.82	0.69

Note: Analyses in weight percent; all Fe analyzed as FeO; H_2O calculated from stoichiometry; UCD = analysis at University of California at Davis, UH = analysis at University of Hawaii; normalization and determination of ferrous:ferric iron ratios discussed in Electron Microprobe Methods.

TABLE DR-2.(cont) ELECTRON MICROPROBE ANALYSES OF AMPHIBOLES

Sample	F94-20		F94-23	F94-54	F94-117	
Rock type	metatuff		metatuff	mafic dike	foliated metadiorite	
Amphibole type	relict volcanic	epitaxial	relict volcanic	igneous	elongate	equant
Laboratory	UCD	UCD	UCD	UCD	UH	UH
Normalization	15eNK	13eNKC	15eNK	15eNK	13eNKC	13eNKC
SiO_2	42.28	54.22	42.75	40.21	44.33	47.13
TiO_2	1.62	<0.16	1.84	3.14	0.37	0.37
Al_2O_3	11.51	1.80	12.90	13.14	11.98	9.86
Cr_2O_3	<0.17	<0.18	<0.17	<0.17	<0.17	<0.17
FeO	13.11	13.77	12.08	10.21	15.45	15.65
MnO	0.25	0.44	0.30	B.D.	0.38	0.35
MgO	14.28	15.71	14.92	15.62	11.32	12.58
CaO	11.80	12.95	11.83	11.98	11.09	11.14
Na_2O	2.42	0.16	2.27	2.44	1.65	1.41
K_2O	0.81	<0.07	0.75	0.73	0.21	0.16
F	<0.58	<0.58	<0.58	<0.58	<0.12	<0.12
Cl	<0.08	<0.08	<0.08	<0.08	<0.17	<0.17
Sum	98.08	99.05	99.64	97.47	96.78	98.65
"Excess O"	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.
Sum	98.08	99.05	99.64	97.47	96.78	98.65
H_2O	2.02	2.10	2.07	2.03	2.01	2.06
Sum	100.10	101.15	101.71	99.50	98.79	100.71
Cations normalized to 23 oxygen						
Si	6.21	7.69	6.13	5.87	6.49	6.72
Al^{IV}	1.79	0.30	1.87	2.13	1.51	1.28
Fe^{3+IV}	0.00	0.01	0.00	0.00	0.00	0.00
Sum	8.00	8.00	8.00	8.00	8.00	8.00
Al^{VI}	0.20	0.00	0.31	0.13	0.55	0.38
Fe^{3+VI}	0.40	0.33	0.40	0.48	0.90	1.00
Ti	0.18	B.D.	0.20	0.34	0.04	0.04
Cr	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.
Mg	3.13	3.32	3.19	3.40	2.47	2.67
Fe^{2+VI}	1.10	1.30	0.91	0.64	1.00	0.87
Mn^{VI}	0.00	0.05	0.00	B.D.	0.05	0.04
Sum	5.00	5.00	5.00	5.00	5.00	5.00
Fe^{2+M4}	0.11	0.00	0.15	0.13	0.00	0.00
Mn^{M4}	0.03	0.00	0.04	B.D.	0.00	0.00
Ca	1.86	1.97	1.82	1.87	1.74	1.70
Na^{M4}	0.00	0.03	0.00	0.00	0.26	0.30
Sum	2.00	2.00	2.00	2.00	2.00	2.00
Na^{A}	0.69	0.01	0.63	0.69	0.21	0.09
K	0.15	B.D.	0.14	0.14	0.04	0.03
Sum	0.84	0.01	0.77	0.83	0.25	0.12
F	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.
Cl	B.D.	B.D.	B.D.	B.D.	B.D.	B.D.
Cations	15.84	15.01	15.77	15.83	15.25	15.12
Mg/(Mg+Fe)	0.72	0.72	0.75	0.82	0.71	0.76

Note: Analyses in weight percent; all Fe analyzed as FeO; H_2O calculated from stoichiometry; UCD = analysis at University of California at Davis, UH = analysis at University of Hawaii; normalization and determination of ferrous:ferric iron ratios discussed in Electron Microprobe Methods.

TABLE DR-3. MEAN (STANDARD DEVIATION) Mg/(Mg+Fe), Si, K2O, AND 0.5*K/Ca OF AMPHIBOLES

Sample	Amphibole type	n	Micro-probe	Norm-alization	Mg/ (Mg+Fe)	Si	K_2O	0.5*K/Ca	Class-ification*
Lowermost greenschist facies metatuffs									
F94-20	relict volcanic	27	UCD	15eNK	0.74 (0.04)	6.17 (0.10)	0.79 (0.05)	0.042 (0.009)	Mg-hast
F94-20	epitaxial	7	UCD	13eNKC	0.73 (0.03)	7.64 (0.10)	0.07 (0.06)	0.003 (0.003)	actinolite
F94-23	relict volcanic	12	UCD	15eNK	0.74 (0.01)	6.25 (0.16)	0.77 (0.05)	0.039 (0.002)	Mg-hast
Epidote-amphibolite facies metadiorites									
F92-36	elongate	27	UH	13eNKC	0.51 (0.01)	5.88 (0.06)	0.47 (0.04)	0.025 (0.002)	pargasite
F92-36	equant	19	UH	13eNKC	0.51 (0.02)	5.90 (0.07)	0.51 (0.05)	0.027 (0.002)	pargasite
F92-36	equant, Al-poor	7	UH	13eNKC	0.84 (0.07)	6.73 (0.07)	0.09 (0.01)	0.005 (0.001)	Mg-hbl
F94-13	elongate	10	UH	13eNKC	0.70 (0.03)	7.06 (0.19)	0.15 (0.04)	0.008 (0.002)	Mg-hbl
F94-13	equant	71	UH	13eNKC	0.72 (0.07)	6.8 (0.2)	0.29 (0.08)	0.016 (0.004)	Mg-hbl
F94-13	equant, Al-poor	14	UH	15eK	0.76 (0.01)	7.71 (0.12)	0.06 (0.03)	0.003 (0.002)	actinolite
F94-117	elongate	41	UH	13eNKC	0.71 (0.04)	6.48 (0.14)	0.21 (0.05)	0.012 (0.003)	tscher
F94-117	equant	56	UH	13eNKC	0.75 (0.07)	6.7 (0.3)	0.17 (0.07)	0.009 (0.004)	Mg-hbl
Dikes									
F92-46	igneous	18	UH	15eNK	0.80 (0.02)	6.15 (0.11)	0.79 (0.05)	0.040 (0.003)	pargasite
F92-46	epitaxial	7	UCD	15eK	0.75 (0.02)	7.78 (0.10)	0.07 (0.05)	0.004 (0.003)	actinolite
F94-54	igneous	62	UCD	15eNK	0.78 (0.05)	5.89 (0.13)	0.67 (0.05)	0.033 (0.003)	Mg-hast
Cascade pluton									
F94-10	plutonic	18	UCD	15eNK	0.63 (0.02)	6.79 (0.14)	0.73 (0.13)	0.039 (0.007)	Mg-hbl

Note: Mg, Fe, Si, K, and Ca are atoms per formula unit on a 23-oxygen basis. Fe is ferrous iron and depends on normalization (see Electron Microprobe Methods); K_2O in weight percent; n = number of microprobe analyses; UCD = analyzed at University of California at Davis; UH = analyzed at University of Hawaii.

*abbreviations: Mg-hast = Mg-hastingsite; Mg-hbl = Mg-hornblende; tscher = tschermakite. Classification of Leake et al. (1997).

TABLE DR-4. DETECTION LIMITS AND RELATIVE COUNTING ERRORS OF ELECTRON MICROPROBE ANALYSES

Element	UCD analyses				UH analyses			
	Lower Limit of Detection (wt% oxide)	Relative Counting Error	@ wt % oxide	counting time (s)	Lower Limit of Detection (wt% oxide)	Relative Counting Error	@ wt % oxide	counting time (s)
F	0.58	10.5%	@ 2.88	10	0.12	7.7%	@ 0.30	18
Na	0.09	7.7%	@ 0.29	10	0.06	2.9%	@ 0.35	18
Na	0.09	3.8%	@ 1.26	10	0.06	1.4%	@ 1.26	18
Mg	0.12	1.0%	@ 12.38	10	0.07	1.0%	@ 11.87	12
Mg	0.12	0.9%	@ 16.58	10	0.07	0.8%	@ 16.58	12
Al	0.07	4.9%	@ 0.45	10	0.06	3.2%	@ 1.01	12
Al	0.07	1.1%	@ 8.63	10	0.06	1.1%	@ 8.63	12
Al	0.07	0.9%	@ 14.32	10	0.06	0.9%	@ 13.14	12
Si	0.10	0.5%	@ 50.46	10	0.06	0.5%	@ 50.46	12
Cl	0.08	40.8%	@ 0.02	10	0.17	14.7%	@ 0.17	12
K	0.07	3.1%	@ 2.14	10	0.08	4.8%	@ 0.76	12
Ca	0.11	1.5%	@ 9.74	10	0.06	1.0%	@ 11.69	12
Ca	0.11	1.1%	@ 15.93	10	0.06	0.8%	@ 15.93	18
Ti	0.16	6.1%	@ 0.79	10	0.08	3.7%	@ 0.79	18
Cr	0.18	11.2%	@ 0.23	10	0.17	11.6%	@ 0.23	12
Mn	0.20	18.6%	@ 0.19	10	0.12	18.8%	@ 0.19	18
Fe	0.20	3.0%	@ 7.02	10	0.13	2.4%	@ 7.02	18

Note: UCD and UH refer to University of California at Davis and University of Hawaii; detection limits calculated as twice the statistical limits; relative counting errors vary with concentration and are listed for more than one concentration for several elements; F and Cl “wt% oxide” values are simple wt% of F and Cl; Fe wt% oxide is reported as FeO.

TABLE DR-5. Ar/Ar DATA

Metamorphic amphibole from foliated metagabbro, Slate Creek metaplutonic unit

Sample F92-36		J=0.0030186			Wt = 31.4 mg			200-250 µm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	2.2e-14	629.906	4.6e-2	11.5867	2.0224	0.042	0.00244	0.051	167.6 ± 149.2
650	3.0e-14	765.368	6.1e-2	7.3608	2.3690	0.067	0.00521	0.085	324.6 ± 168.2
750	6.8e-14	884.367	2.7e-2	9.4296	2.8526	0.052	0.01072	0.047	212.5 ± 115.4
850	2.5e-14	182.535	1.2e-2	11.0995	0.5181	0.044	0.02061	0.161	153.5 ± 14.9
900	2.4e-14	43.421	1.8e-3	12.1158	0.0456	0.040	0.05948	0.690	156.2 ± 3.0
950	7.7e-14	32.793	0.0e+0	10.8076	0.0103	0.045	0.22591	0.908	155.2 ± 1.2
975	5.1e-14	32.733	3.5e-4	12.2217	0.0098	0.040	0.33640	0.912	155.6 ± 1.4
1000	5.0e-14	35.226	5.5e-3	18.3018	0.0175	0.027	0.43746	0.854	156.7 ± 2.5
1015	3.9e-14	36.297	9.6e-3	22.7759	0.0195	0.022	0.51526	0.841	159.0 ± 2.5
1030	1.9e-14	34.395	8.8e-3	22.8162	0.0163	0.021	0.55541	0.860	154.3 ± 3.0
1050	4.5e-15	33.829	1.6e-3	14.4150	0.0189	0.034	0.56491	0.835	147.7 ± 7.2
1070	6.4e-15	34.932	3.3e-3	15.0097	0.0209	0.033	0.57804	0.823	150.1 ± 5.5
1090	6.5e-15	36.083	2.6e-3	15.2984	0.0169	0.032	0.59089	0.862	161.9 ± 6.1
1105	6.6e-15	34.625	0.0e+0	14.8553	0.0131	0.033	0.60454	0.888	160.2 ± 5.9
1120	1.1e-14	37.060	0.0e+0	14.4059	0.0231	0.034	0.62517	0.816	157.5 ± 4.3
1135	2.5e-14	38.121	4.0e-3	14.2497	0.0279	0.034	0.67165	0.784	155.8 ± 2.6
1150	4.2e-14	37.687	2.7e-3	15.1277	0.0228	0.032	0.75122	0.822	161.2 ± 1.9
1165	4.5e-14	35.777	2.7e-3	14.4472	0.0190	0.034	0.84045	0.843	157.1 ± 1.7
1180	2.9e-14	32.642	0.0e+0	12.8240	0.0107	0.038	0.90318	0.903	153.8 ± 2.0
1250	3.8e-14	31.726	1.4e-3	12.1992	0.0072	0.040	0.98863	0.933	154.3 ± 1.6
1350	4.9e-15	30.872	0.0e+0	12.3504	0.0031	0.040	1.00000	0.971	156.2 ± 6.0

Total fusion age, TFA= 157.1 ± 1.1 Ma (including J)

Weighted mean age, WMA= 156.1 ± 0.6 Ma (including J)

Inverse isochron age =155.8 ± 0.6 Ma. (MSWD =1.44; 40Ar/36Ar=299.0 ± 1.6)

Igneous amphibole from dike intrusive into Slate Creek metaplutonic unit

Sample F92-46		J=0.0030001			Wt = 21.4 mg			100-250 µm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	2.10E-14	125.245 4	7.60E-03	2.4478	0.3499	0.200	0.00673	0.174	114.5 ± 8.9
650	2.20E-14	46.9968	0.00E+00	1.0110	0.0717	0.480	0.02558	0.549	134.6 ± 2.3
750	4.10E-14	62.5336	0.00E+00	0.8446	0.1264	0.580	0.05224	0.403	131.4 ± 2.1
850	4.60E-14	55.8838	2.40E-03	1.1632	0.1053	0.420	0.08549	0.443	129.3 ± 1.8
900	2.10E-14	38.5479	0.00E+00	2.9789	0.0523	0.160	0.10801	0.599	120.8 ± 2.2
950	2.10E-14	39.8008	0.00E+00	12.8859	0.0632	0.038	0.13006	0.531	110.9 ± 3.1
975	1.50E-14	42.2994	3.00E-03	11.5028	0.0634	0.043	0.14444	0.557	123.3 ± 3.9
1000	1.30E-14	36.9768	0.00E+00	7.3972	0.0376	0.066	0.15928	0.699	134.8 ± 3.6
1015	1.10E-14	32.5693	0.00E+00	6.6649	0.0219	0.074	0.17374	0.801	136.0 ± 2.7
1030	1.80E-14	30.8248	1.20E-03	6.5029	0.0129	0.075	0.19774	0.876	140.6 ± 2.2
1050	4.10E-14	30.3475	9.30E-04	6.6206	0.0099	0.074	0.25327	0.904	142.6 ± 1.2
1070	9.70E-14	29.5781	1.10E-04	6.7499	0.0074	0.073	0.38780	0.926	142.4 ± 0.7
1080	5.90E-14	29.7212	8.20E-04	6.7683	0.0085	0.072	0.46864	0.916	141.6 ± 1.1
1090	2.20E-14	30.5664	9.50E-04	7.0412	0.0119	0.070	0.49880	0.885	140.8 ± 2.3
1105	1.40E-14	31.3925	4.00E-04	6.8474	0.0148	0.072	0.51748	0.861	140.7 ± 2.8
1120	1.70E-14	32.1679	1.20E-03	7.2406	0.0156	0.068	0.53935	0.857	143.3 ± 2.2
1135	2.30E-14	31.3362	0.00E+00	7.0514	0.0132	0.069	0.56907	0.875	142.7 ± 1.8
1150	4.10E-14	30.9589	0.00E+00	6.8672	0.0115	0.071	0.62307	0.891	143.4 ± 1.3
1165	8.70E-14	30.8576	7.10E-05	6.7141	0.0104	0.073	0.73902	0.900	144.4 ± 0.9
1180	1.40E-13	30.4279	0.00E+00	6.7631	0.0090	0.072	0.93431	0.912	144.3 ± 0.8
1250	4.30E-14	29.9853	0.00E+00	6.8128	0.0079	0.072	0.99348	0.922	143.8 ± 1.2
1350	4.80E-15	30.4788	0.00E+00	7.2014	0.0091	0.068	1.00000	0.911	144.4 ± 5.6

Total fusion age, TFA= 140.3 ± 0.4 Ma (including J)

Weighted mean age, WMA= 143.2 ± 0.4 Ma (including J)

Inverse isochron age =141.2 ± 1.8 Ma. (MSWD =1.22; 40Ar/36Ar=340 ± 40)

TABLE DR-5$^{(cont.)}$ Ar/Ar DATA

Igneous amphibole from granodiorite of Cascade pluton

Sample F94-10		J= 0.0029814			Wt = 25.0 mg			250-350 µm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	2.70E-14	127.4003	0.00E+00	1.2880	0.3746	0.380	0.00428	0.131	87.8 ± 7.7
650	8.70E-14	56.8749	0.00E+00	0.1582	0.1047	3.100	0.03472	0.456	134.4 ± 1.3
750	8.10E-14	37.5051	0.00E+00	0.1187	0.0239	4.100	0.07747	0.811	156.7 ± 0.6
850	6.30E-14	38.1711	0.00E+00	0.3900	0.0257	1.300	0.11026	0.801	157.5 ± 0.8
900	3.90E-14	40.3245	0.00E+00	0.9338	0.0336	0.520	0.12930	0.754	156.5 ± 1.2
950	4.50E-14	35.1161	0.00E+00	2.3865	0.0158	0.210	0.15479	0.867	156.8 ± 1.1
975	3.00E-14	33.3850	2.70E-04	2.7658	0.0106	0.180	0.17292	0.906	155.8 ± 1.2
1000	4.60E-14	33.5415	0.00E+00	4.6083	0.0136	0.110	0.20055	0.880	152.2 ± 1.1
1015	1.70E-13	32.2496	0.00E+00	6.5017	0.0107	0.075	0.30497	0.902	150.1 ± 0.6
1025	3.80E-13	30.9583	1.10E-03	6.8581	0.0065	0.071	0.54836	0.938	149.8 ± 0.2
1035	1.20E-13	29.6512	1.10E-03	6.5171	0.0024	0.075	0.63219	0.976	149.3 ± 0.7
1045	2.60E-14	30.1510	1.30E-03	6.2148	0.0037	0.079	0.64911	0.964	149.9 ± 1.7
1055	1.80E-14	30.5623	0.00E+00	6.2382	0.0043	0.079	0.66117	0.958	151.0 ± 1.8
1065	1.90E-14	30.2387	0.00E+00	6.4143	0.0041	0.076	0.67385	0.960	149.7 ± 2.3
1080	3.30E-14	29.9620	0.00E+00	6.7667	0.0039	0.072	0.69619	0.961	148.6 ± 1.6
1100	2.30E-14	30.5051	0.00E+00	7.5731	0.0043	0.065	0.71099	0.958	150.8 ± 2.0
1120	4.70E-14	30.5848	0.00E+00	7.3724	0.0055	0.066	0.74157	0.947	149.4 ± 1.4
1135	9.00E-14	30.7930	3.80E-04	7.1072	0.0053	0.069	0.80017	0.949	150.7 ± 0.8
1150	9.30E-14	30.5113	5.00E-04	7.1163	0.0047	0.069	0.86130	0.954	150.2 ± 0.8
1165	7.40E-14	30.3492	3.70E-04	6.8307	0.0040	0.072	0.91020	0.961	150.4 ± 0.8
1180	7.20E-14	30.3039	2.80E-04	6.7799	0.0039	0.072	0.95783	0.962	150.3 ± 0.9
1250	5.50E-14	30.0861	1.20E-03	6.8157	0.0037	0.072	0.99435	0.964	149.6 ± 1.0
1350	8.60E-15	30.3315	1.90E-03	6.7543	0.0048	0.073	1.00000	0.954	149.2 ± 3.4

Total fusion age, TFA= 150.2 ± 0.2 Ma (including J)

Weighted mean age, WMA= 149.8 ± 0.2 Ma (including J)

Inverse isochron age = 151.0 ± 0.7 Ma. (MSWD =34.89; 40Ar/36Ar=283 ± 9))

Metamorphic amphibole massive metadiorite, Slate Creek metaplutonic unit

Sample F94-13		J = 0.0029626			Wt = 28.9 mg			125-180 µm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	1.60E-14	138.0519	4.60E-02	8.1764	0.3937	0.060	0.00584	0.157	112.4 ± 17.5
650	1.50E-14	67.2288	1.00E-02	4.8478	0.1419	0.100	0.01697	0.376	130.3 ± 5.6
750	2.30E-14	75.2487	0.00E+00	2.7225	0.1606	0.180	0.03229	0.369	142.7 ± 4.2
850	1.90E-14	47.8583	3.10E-03	7.5198	0.0783	0.065	0.05248	0.517	127.6 ± 3.3
900	2.20E-14	40.7089	4.20E-03	22.2791	0.0431	0.022	0.08041	0.687	143.6 ± 4.2
950	7.10E-14	41.1909	1.00E-02	25.5925	0.0309	0.019	0.16886	0.778	163.7 ± 2.1
975	1.60E-13	40.0328	2.10E-02	18.2223	0.0177	0.027	0.37825	0.870	177.0 ± 1.2
1000	1.70E-13	39.8043	2.80E-02	16.5038	0.0126	0.030	0.59939	0.907	183.2 ± 0.9
1015	3.90E-14	40.6836	2.30E-02	16.8879	0.0174	0.029	0.64774	0.873	180.5 ± 2.5
1030	1.90E-14	42.1204	2.20E-02	17.6389	0.0230	0.028	0.67067	0.838	179.4 ± 4.0
1050	1.60E-14	43.2687	2.10E-02	19.2610	0.0247	0.025	0.68965	0.831	182.6 ± 4.8
1070	1.90E-14	45.2084	1.70E-02	20.4928	0.0308	0.024	0.71069	0.799	183.4 ± 4.4
1090	1.30E-14	48.7940	2.30E-02	20.6981	0.0410	0.024	0.72467	0.751	186.0 ± 5.6
1105	1.50E-14	48.1353	1.60E-02	21.1194	0.0376	0.023	0.74008	0.769	187.7 ± 5.6
1120	2.40E-14	48.8694	2.20E-02	20.9294	0.0415	0.023	0.76483	0.749	185.7 ± 4.3
1135	3.50E-14	48.1671	2.40E-02	19.0451	0.0388	0.026	0.80197	0.762	186.2 ± 2.7
1150	4.30E-14	46.4976	2.90E-02	17.9355	0.0311	0.027	0.84882	0.802	189.0 ± 2.4
1180	8.60E-14	43.2491	2.90E-02	17.1733	0.0206	0.029	0.94945	0.860	188.4 ± 2.6
1250	4.00E-14	42.8797	2.90E-02	17.0035	0.0153	0.029	0.99674	0.895	194.2 ± 2.7
1350	2.70E-15	42.4221	2.40E-02	18.0404	0.0284	0.027	1	0.802	173.2 ± 14.9

Total fusion age, TFA= 177.7 ± 0.6 Ma (including J)

TABLE DR-5$^{(cont.)}$ Ar/Ar DATA

Relict volcanic amphibole from the Lexington Hill volcanics, Slate Creek complex

Sample F94-20		J = 0.0029437			Wt = 21.7 mg			200-250 μm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	2.50E-14	75.3638	6.60E-03	3.1175	0.1702	0.1600	0.00589	0.333	128.4 ± 4.5
650	5.90E-14	70.1316	0.00E+00	1.1022	0.1179	0.4400	0.02082	0.503	178.3 ± 2.1
750	1.20E-13	86.1419	0.00E+00	1.3097	0.1780	0.3700	0.04504	0.390	169.9 ± 1.9
850	1.10E-13	41.9453	0.00E+00	1.4545	0.0385	0.3400	0.09247	0.729	155.5 ± 1.5
900	4.80E-14	38.1791	1.90E-04	9.8298	0.0363	0.0500	0.11517	0.719	140.2 ± 1.6
950	5.00E-14	39.5468	2.40E-03	27.0934	0.0386	0.0180	0.13825	0.712	143.6 ± 2.2
975	4.30E-14	39.7724	2.30E-03	14.7965	0.0236	0.0330	0.15761	0.824	166.2 ± 2.1
1000	4.10E-14	38.5159	4.80E-03	11.0145	0.0181	0.0440	0.17678	0.861	168.0 ± 1.9
1015	3.60E-14	37.6504	5.80E-03	9.6109	0.0130	0.0510	0.19408	0.898	171.1 ± 2.1
1030	5.30E-14	36.4641	4.10E-03	8.2765	0.0093	0.0590	0.22005	0.925	170.7 ± 1.5
1050	1.30E-13	35.7086	3.70E-03	7.1409	0.0059	0.0690	0.28433	0.951	171.9 ± 0.8
1070	2.20E-13	35.3713	3.60E-03	6.9016	0.0047	0.0710	0.39388	0.960	171.9 ± 0.7
1090	1.20E-13	35.6998	3.10E-03	6.9220	0.0055	0.0710	0.45397	0.954	172.4 ± 0.8
1100	4.20E-14	36.5311	3.70E-03	7.8467	0.0091	0.0620	0.47437	0.927	171.3 ± 1.9
1110	5.00E-14	36.4977	3.90E-03	8.0700	0.0089	0.0610	0.49867	0.928	171.4 ± 1.4
1120	6.30E-14	36.8221	4.40E-03	8.0535	0.0101	0.0610	0.52914	0.919	171.3 ± 1.4
1135	1.10E-13	37.0062	3.90E-03	7.7263	0.0101	0.0630	0.58295	0.920	172.2 ± 1.1
1150	1.90E-13	36.7219	3.30E-03	6.9104	0.0089	0.0710	0.67556	0.928	172.5 ± 0.7
1165	4.00E-13	36.6370	3.70E-03	6.3570	0.0085	0.0770	0.87000	0.932	172.7 ± 0.2
1180	1.50E-13	36.0689	2.60E-03	6.3146	0.0070	0.0780	0.94328	0.943	172.1 ± 0.8
1250	1.00E-13	35.9852	3.30E-03	6.4992	0.0067	0.0750	0.99356	0.945	172.1 ± 0.9
1350	1.30E-14	36.1747	3.00E-03	6.3968	0.0068	0.0770	1.00000	0.944	172.8 ± 2.9

Total fusion age, TFA= 169.6 ± 0.3Ma (including J)

Weighted mean age, WMA= 172.5 ± 0.2Ma (including J)

Inverse isochron age = 171.4 ± 0.9 Ma. (MSWD =0.72; 40Ar/36Ar=324 ± 20)

Relict volcanic amphibole from the Lexington Hill volcanics, Slate Creek complex

Sample F94-23		J = 0.0029247			Wt = 23.5 mg			200-250 μm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	2.30E-14	216.8949	1.70E-02	4.7985	0.6666	0.1000	0.00367	0.092	102.1 ± 20.1
650	4.20E-14	127.7719	3.30E-03	1.5950	0.3416	0.3100	0.01535	0.210	136.2 ± 6.0
750	1.10E-13	116.7973	2.10E-03	1.4329	0.3185	0.3400	0.04984	0.194	115.8 ± 3.1
850	8.50E-14	57.2649	0.00E+00	3.0907	0.1074	0.1600	0.10207	0.446	129.8 ± 1.4
900	4.10E-14	51.4690	1.40E-03	20.9493	0.0852	0.0230	0.13072	0.511	133.6 ± 3.0
950	4.90E-14	55.4390	2.40E-03	54.5304	0.0994	0.0090	0.16356	0.470	132.6 ± 4.1
975	2.50E-14	41.0993	3.60E-03	18.4708	0.0451	0.0270	0.18554	0.676	140.8 ± 3.0
1000	2.30E-14	35.4363	2.10E-03	11.0001	0.0251	0.0450	0.20852	0.791	142.1 ± 2.2
1015	1.60E-14	33.1198	1.30E-03	9.2614	0.0221	0.0530	0.22573	0.803	135.1 ± 3.0
1030	1.70E-14	33.3157	1.90E-03	8.2808	0.0170	0.0590	0.24423	0.849	143.4 ± 3.0
1050	4.80E-14	35.0276	3.00E-03	7.3334	0.0120	0.0670	0.29231	0.898	158.8 ± 1.3
1070	1.60E-13	35.4891	3.10E-03	7.3516	0.0084	0.0670	0.44850	0.930	166.2 ± 0.7
1090	7.80E-14	36.1749	2.80E-03	9.2732	0.0116	0.0530	0.52485	0.905	165.0 ± 1.1
1105	3.10E-14	49.8117	2.20E-03	13.0897	0.0566	0.0370	0.54699	0.664	166.6 ± 2.9
1120	2.90E-14	39.6802	4.60E-03	15.0001	0.0222	0.0330	0.57327	0.835	166.8 ± 2.8
1135	4.10E-14	41.2061	3.10E-03	13.3861	0.0242	0.0370	0.60910	0.826	171.2 ± 2.5
1150	7.00E-14	40.2847	3.50E-03	10.3414	0.0229	0.0470	0.67061	0.832	168.7 ± 1.5
1165	1.50E-13	39.0749	3.50E-03	8.8265	0.0182	0.0560	0.80393	0.863	169.6 ± 0.8
1180	1.50E-13	38.9287	3.10E-03	8.9458	0.0171	0.0550	0.94004	0.870	170.4 ± 0.9
1250	6.20E-14	38.8652	2.60E-03	10.2970	0.0164	0.0480	0.99626	0.875	171.1 ± 1.6
1350	4.00E-15	38.5116	8.50E-04	10.2764	0.0154	0.0480	1.00000	0.882	170.9 ± 8.8

Total fusion age, TFA= 159.2 ± 0.4Ma (including J)

Weighted mean plateau age, WMPA= 170.0 ± 0.5 Ma (including J)

Inverse isochron age = 171.9 ± 3.3 Ma. (MSWD =0.65; 40Ar/36Ar=270 ± 30)

TABLE DR-5[cont.] Ar/Ar DATA

Igneous amphibole from dike intruding Gold Run formation

Sample F94-54		J = 0.0029056			Wt = 23.9 mg			200-250 μm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	6.00E-14	154.7403	1.30E-02	3.0487	0.4365	0.1600	0.00846	0.166	130.1 ± 6.3
650	1.20E-13	117.1801	1.60E-03	2.0789	0.3014	0.2400	0.02990	0.240	141.6 ± 3.1
700	9.50E-14	128.9696	0.00E+00	1.1959	0.3415	0.4100	0.04598	0.218	141.4 ± 3.7
750	1.20E-13	181.2289	0.00E+00	1.0648	0.5163	0.4600	0.06083	0.158	144.3 ± 5.0
850	1.40E-13	102.6742	1.50E-03	2.4675	0.2542	0.2000	0.09151	0.268	138.9 ± 2.3
900	1.10E-13	96.7385	1.90E-03	11.3612	0.2285	0.0430	0.11754	0.302	147.0 ± 3.0
950	1.00E-13	91.0668	1.50E-03	13.4511	0.2066	0.0360	0.14195	0.330	150.9 ± 2.7
975	4.80E-14	70.4266	2.80E-03	8.0397	0.1384	0.0610	0.15699	0.419	148.5 ± 2.9
1000	4.30E-14	50.6892	2.50E-03	7.2645	0.0764	0.0670	0.17559	0.554	141.6 ± 2.4
1015	3.00E-14	42.5100	1.70E-03	6.8700	0.0507	0.0710	0.19091	0.648	138.8 ± 2.4
1030	2.90E-14	35.7665	1.00E-03	6.9651	0.0279	0.0700	0.20843	0.770	138.8 ± 1.9
1050	8.20E-14	32.1556	1.60E-03	7.8327	0.0146	0.0630	0.26424	0.866	140.3 ± 1.1
1070	1.80E-13	31.5602	8.20E-04	8.1008	0.0119	0.0600	0.38917	0.888	141.3 ± 0.8
1090	1.40E-13	32.5574	1.50E-03	7.9713	0.0152	0.0610	0.48384	0.862	141.5 ± 0.8
1105	8.80E-14	32.3828	5.70E-04	7.8593	0.0158	0.0620	0.54317	0.856	139.7 ± 1.1
1120	6.90E-14	35.5359	1.30E-03	8.3487	0.0246	0.0590	0.58565	0.795	142.3 ± 1.2
1135	9.70E-14	38.4091	1.30E-03	8.9180	0.0316	0.0550	0.64073	0.757	146.3 ± 1.4
1150	1.50E-13	39.5951	1.10E-03	8.8827	0.0345	0.0550	0.72161	0.742	147.8 ± 1.1
1165	2.70E-13	37.7062	1.20E-03	8.5059	0.0286	0.0580	0.87740	0.776	147.2 ± 0.6
1180	1.40E-13	35.9327	7.40E-04	8.2048	0.0239	0.0600	0.96297	0.803	145.3 ± 0.9
1250	4.60E-14	35.8636	3.80E-04	8.3778	0.0233	0.0580	0.99088	0.808	145.8 ± 1.9
1350	1.50E-14	36.4702	2.30E-03	8.2647	0.0251	0.0590	1.00000	0.797	146.2 ± 3.3

Total fusion age, TFA= 143.7 ± 0.3Ma (including J)

Weighted mean plateau age, WMPA= 144.0 ± 0.3 Ma (including J)

Inverse isochron age (based on 10 highest-T steps) = 135.8 ± 1.2 Ma. (MSWD =1.71; 40Ar/36Ar=372 ± 10)

Metamorphic amphibole from foliated metadiorite, Slate Creek metaplutonic unit

Sample F94-117		J = 0.0028863			Wt = 28.4 mg			200-250 μm grain size	
T (°C)	^{40}Ar(mol)	^{40}Ar/^{39}Ar	^{38}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	• ^{39}Ar	^{40}Ar*	Age (Ma) ± 1σ
550	4.60E-14	774.1777	2.00E-02	10.0458	2.5620	0.0490	0.00304	0.022	86.8 ± 92.6
650	6.30E-14	461.6852	1.50E-02	7.2925	1.4415	0.0670	0.01002	0.077	177.0 ± 28.0
750	1.00E-13	313.5518	7.00E-03	7.4568	0.9571	0.0660	0.02646	0.098	153.3 ± 12.8
850	9.80E-14	112.3196	1.30E-03	5.4555	0.2819	0.0900	0.07113	0.258	145.1 ± 3.4
900	2.40E-14	53.1565	1.50E-03	7.6835	0.0844	0.0640	0.09376	0.531	141.3 ± 3.4
950	1.90E-14	52.5041	1.90E-03	19.5341	0.0855	0.0250	0.11285	0.519	136.6 ± 5.1
975	2.00E-14	53.5116	5.10E-03	25.9895	0.0828	0.0190	0.13248	0.543	145.1 ± 5.6
1000	1.80E-13	48.6577	6.70E-03	30.5206	0.0603	0.0160	0.32241	0.634	153.8 ± 1.6
1010	7.30E-14	40.8908	3.80E-03	26.5568	0.0355	0.0180	0.41468	0.743	151.7 ± 2.1
1020	2.30E-14	41.2372	3.70E-03	25.0774	0.0392	0.0200	0.44374	0.719	148.1 ± 3.7
1030	1.00E-14	41.9034	3.10E-03	24.0399	0.0425	0.0200	0.45607	0.700	146.6 ± 7.5
1050	7.60E-15	43.4456	1.50E-03	23.6547	0.0474	0.0210	0.46514	0.678	147.1 ± 8.6
1070	1.50E-14	42.3225	2.80E-03	23.1927	0.0429	0.0210	0.48398	0.700	148.1 ± 5.7
1090	4.60E-14	38.1770	1.20E-03	22.7327	0.0286	0.0220	0.54630	0.779	148.5 ± 2.8
1105	2.10E-14	39.0005	0.00E+00	23.5352	0.0313	0.0210	0.57431	0.763	148.7 ± 4.3
1120	2.10E-14	39.5413	1.50E-03	24.4220	0.0333	0.0200	0.60245	0.751	148.4 ± 4.3
1135	5.10E-14	40.8900	1.50E-03	24.0392	0.0357	0.0200	0.66688	0.742	151.4 ± 2.7
1150	1.00E-13	42.1061	2.50E-03	24.0688	0.0388	0.0200	0.79277	0.728	152.8 ± 1.5
1165	1.20E-13	43.2344	2.70E-03	24.2277	0.0422	0.0200	0.93710	0.711	153.4 ± 1.8
1180	2.60E-14	43.4733	2.70E-03	25.2561	0.0441	0.0190	0.96878	0.701	152.0 ± 3.9
1250	2.00E-14	43.0448	1.70E-03	25.5411	0.0401	0.0190	0.99252	0.724	155.5 ± 4.3
1350	6.00E-15	41.5832	4.80E-03	24.7638	0.0380	0.0200	1.00000	0.730	151.5 ± 9.9

Total fusion age, TFA= 151.0 ± 0.8 Ma (including J)

Weighted mean plateau age, WMPA= 152.0 ± 0.7 (including J)

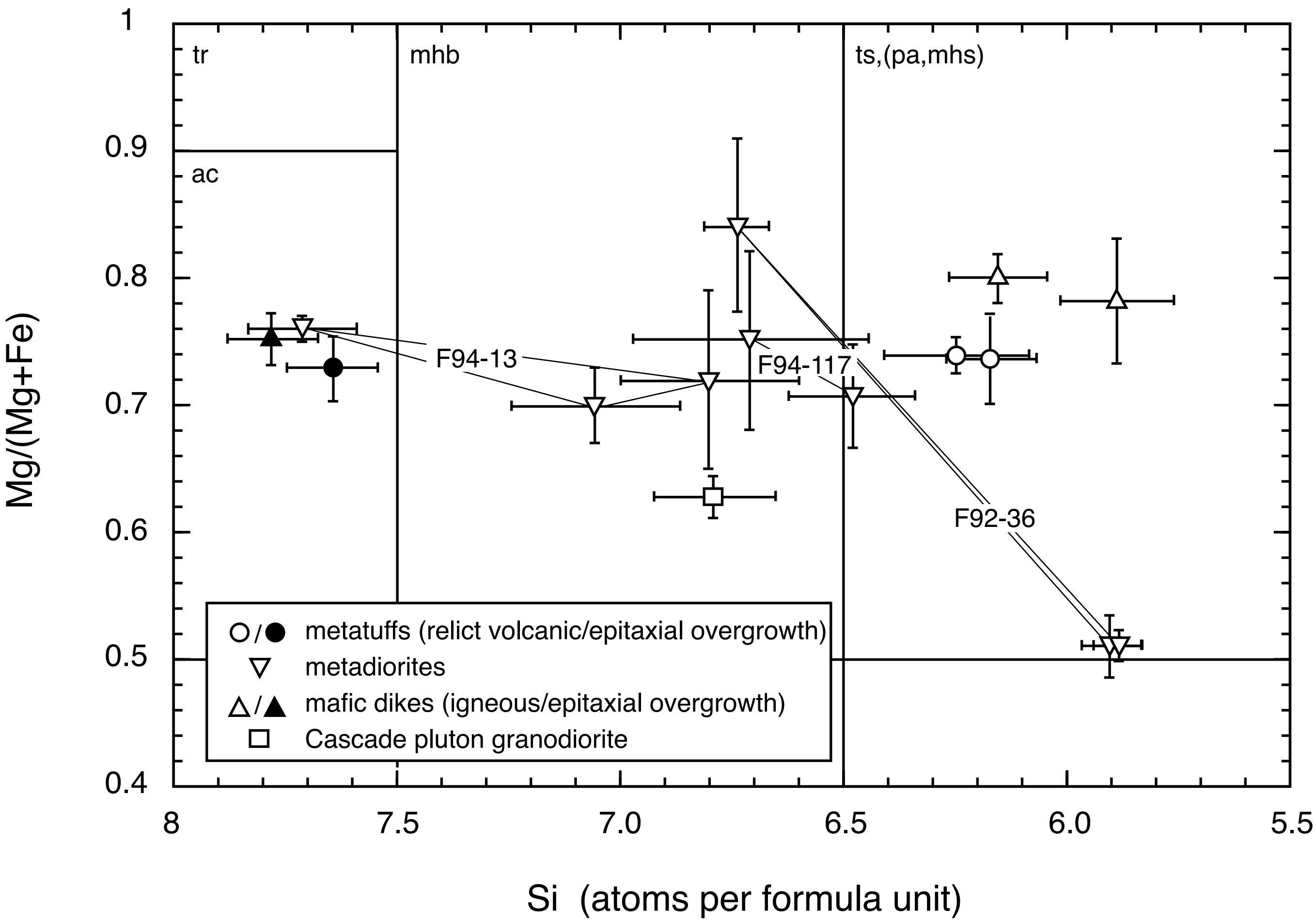
Inverse isochron age = 151.4 ± 1.1 Ma. (MSWD =2.93; 40Ar/36Ar=294.6 ± 1.5)

Note: T: temperature; ^{40}Ar (mol) = moles corrected for blank and reactor-produced ^{40}Ar. Ratios are corrected for blanks, decay, and interference. •^{39}Ar is cumulative, ^{40}Ar* = radiogenic fraction of ^{40}Ar; MSWD: mean sum of weighted deviates; expresses the goodness of fit of the isochron and has an expected value of ~1.94 (Wendt and Carl, 1991).

DATA REPOSITORY FIGURES CAPTIONS

Figure DR-1. Mean Si and Mg/(Mg + Fe) of amphiboles in samples from which $^{40}Ar/^{39}Ar$ data were collected, after Leake et al. (1997). Labelled lines connect the amphibole teypes identifies in the metaplutonic samples (see Tables DR-2; DR-3). Error bars are $\pm1\sigma$ (see Table DR-3). Field labels: tr, tremolite; ac, actinolite; mhb, magnesiohornblende; ts, tschermakite; pa, pargasite; mhs, magnesiohastingsite. Tschermakite, pargasite, and magnesiohastingsite distinguished by concentration of alkalies and ratio of ferric iron to aluminum.

Figure DR-2. Photomicrographs of amphiboles separated for $^{40}Ar/^{39}Ar$ analyses. All in transmitted, plane-polarized light except for A, which is in cross-polarized light. Fields of view are 1 mm for A and B, and 2.6 mm for C, D, E, and F. (A) Relict volcanic phenocryst, F94-20, Lexington Hill volcanics. Light-colored, low-relief fringe at lower right end of prism is actinolitic overgrowth. (B) Relict volcanic phenocryst, F94-23, Lexington Hill volcanics. Note abundance of inclusions compared to F94-20. (C) Elongate to acicular (a) and equant (q) varieties of amphibole from foliated metadiorite, F92-36, Slate Creek complex metaplutonic unit. Foliation is parallel to length of photograph. (D) Equant metaplutonic amphibole overgrown by prominent elongate amphibole at upper left, F94-13, Slate Creek complex metaplutonic section. Light zone in middle of equant amphibole is caused by thinning of amphibole crystal and zoning to more Mg-rich compositions. (E) Igneous plutonic amphibole, F94-10, Cascade pluton. (F) Amphibole phenocrysts in dike, F94-54, intrusive into Gold Run formation.



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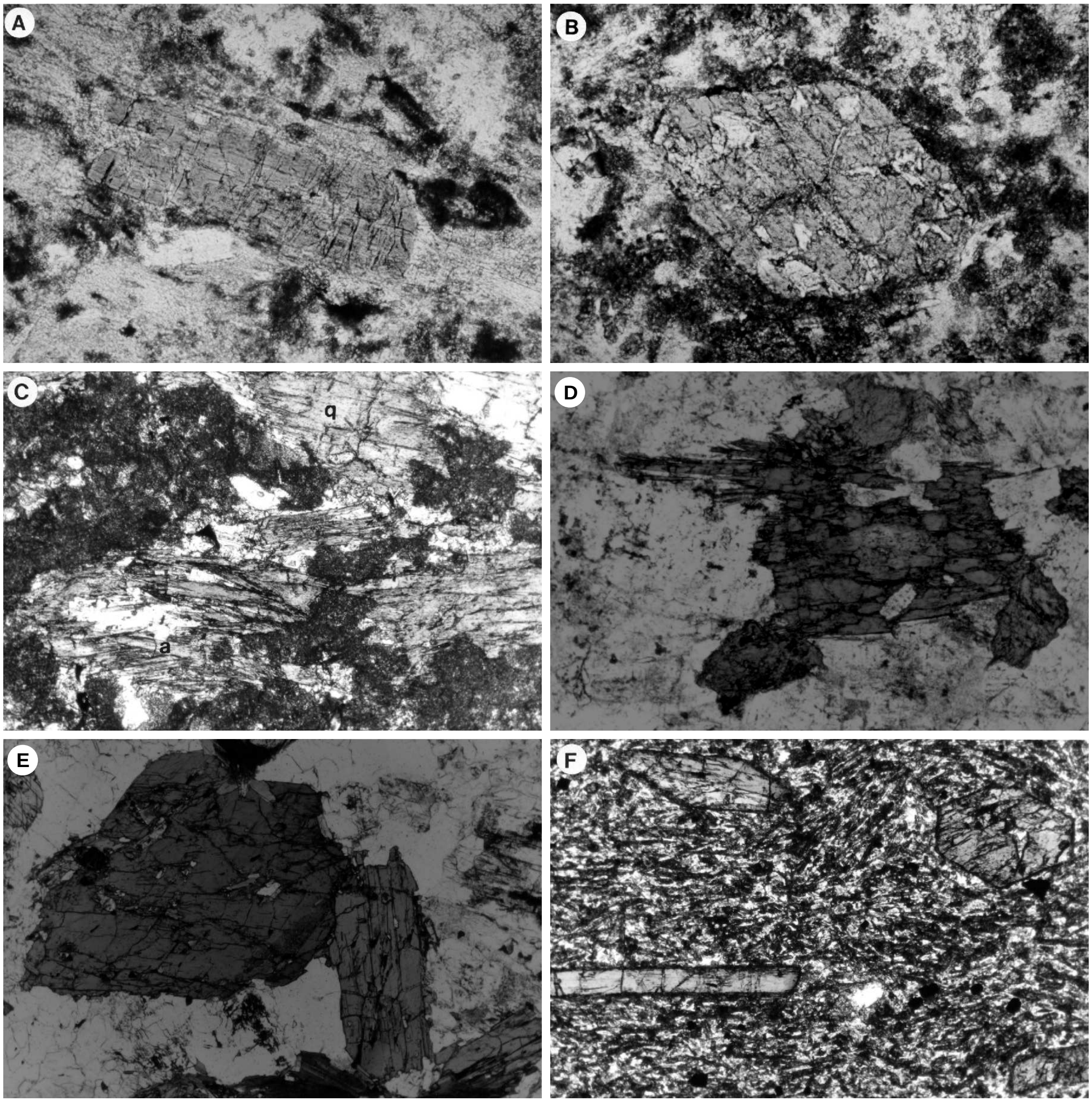

*Final versions of A-F all to be submitted as hard-copy photographs.