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DATA TABLES RELATED TO GEOLOGY AND GOLD MINERALIZATION IN THE RICHARDSON DISTRICT, EAST-CENTRAL ALASKA

by

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Note: This report (including all analytical data and tables) is available in digital format from the DGGS web site (http://wwwdggs.dnr.state.ak.us) at no charge. The digital data is available as PDF files and Excel spreadsheets.

DATA TABLES RELATED TO GEOLOGY AND GOLD MINERALIZATION IN THE RICHARDSON DISTRICT, EAST-CENTRAL ALASKA

by
Garth Erik Graham[1] and Diana Jozwik[2]

INTRODUCTION

The data included in this report were published by Garth Graham as part of his Master of Science thesis at the University of Alaska Fairbanks in 2002 (Graham, 2002). Diana Jozwik compiled the data and selected text for use in this publication to enable easier public access to the data. Data tables shown here were renumbered and formatted to fit this report. Selected informative text was taken from the thesis, merged, and edited for content. More complete discussion of the subjects covered in this report is included in Graham's thesis, available at the University of Alaska Fairbanks (QE84.A4 G73 2002 AK). The abstract from the thesis is given below:

ABSTRACT

"The Richardson district contains multiple granitic units intruding gneiss and schist. The Bald Knob prospect contains gold-bearing quartz veins with the assemblage Bi–Au–hedleyite and high methane fluid inclusions. These features indicate very low f_{S2}–f_{O2} conditions, lower than any reported for 90 Ma interior Alaska gold systems, including the nearby Democrat and Buckeye prospects.

The Bald Knob and Democrat Lode prospects returned $^{40}Ar/^{39}Ar$ ages of ~104 and ~90 Ma, respectively. Peraluminous dikes possess collisional tectonic signatures and interpreted age of 114 Ma. Younger dikes and a 3 km^2 granite body possess arc-type compositions and $^{40}Ar/^{39}Ar$ ages of ~90 Ma.

Garnet–biotite geothermometry on metamorphic rocks indicates low-P regional metamorphism (550–600ºC; 3–4 kb) and vertical movement between adjacent fault blocks. Highest temperatures are in the fault block hosting the Bald Knob prospect, suggesting it represents the deepest mineralization exposure in the area and is most proximal to a causative pluton."

Graham's thesis describes the results of geologic mapping and sample analyses from the Richardson district, east-central Alaska, west-central Big Delta B-5 Quadrangle. The objective of the thesis was to create a better geologic map of a portion of the Richardson district and to propose a model for the geological evolution of the Richardson area. During the summers of 1999 and 2000, the study area was mapped on foot; more than 400 field stations were recorded and more than 300 rock samples collected. Location data (in UTM coordinates with a Clark 1866, NAD27, UTM zone 6 projection), rock type, and method of analysis for each sample are shown in table 1. Magnetic susceptibility measurements, included in table 1, were made with a Kappameter model KT-6 magnetic susceptibility meter. Multiple measurements were routinely made on a single sample and the results averaged.

ANALYTICAL METHODS AND RESULTS

Placer Dome Exploration (PDX) conducted a large-scale soil sampling program in the area in 1999 and 2000. Hand samples were also collected from various locations during concurrent geologic mapping. The geochemical results from these activities were used to determine subsequent core drilling in both 1999 and 2000. Thirty thin sections, 15 doubly-polished from vein samples, 12 polished sections, and one white mica separate were selected from the core drilled by PDX during 1999 and 2000. This core was halved with a rock saw with one-half of each interval sent for assay and the other retained for additional studies.

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Modal estimates were conducted on 36 metamorphic and four igneous hand specimens that were etched and stained for quartz, plagioclase, and K-feldspar using the technique of Ruperto and others (1964). K-feldspar assumed a bright yellow color, plagioclase stained red, and quartz remained unstained. Modal estimates were made either by standard point-counting using a minimum of 100 points, or by estimation by comparison to standard abundance charts. Modal abundances are listed in tables 2 and 3.

Major- and minor-oxide analyses were performed by Bondar-Clegg, Incorporated, Vancouver, British Columbia, Canada, on 39 rock samples, including 13 from drill core. Samples were crushed and pulverized in Fairbanks before pulps were shipped to Vancouver. Major- and minor-oxide values were obtained using lithium results, including normative values, are listed in tables 4, 5 and 6. Trace-element analyses for 34 of the samples were performed on pressed pellets at the University of Alaska Fairbanks on splits of the pulverized samples using a Rigaku energy-dispersive XRF and a routine created by Rainer Newberry (described in Cameron, 2000). The results of 16 of the samples are listed in tables 5 and 7. Replicate and secondary standard analyses for commercial and UAF XRF analyses indicate major oxides are accurate to within 2 percent of the amount present, while trace elements are accurate to within 5–10 percent of the amount present (Cameron, 2000).

Microprobe data collected on biotite, garnet, white mica, and K-feldspar were processed using the MacIntosh Geothermobarometry program GTB (Spear and Kohn, 1999). Temperatures were calculated for 12 different garnet–biotite distribution models. Of these 12, those of Perchuk and Lavrenteva (1984) and Kleeman and Reinhardt (1994) with Berman (1990) produced similar, consistent temperatures intermediate to those of other models and were selected as most appropriate for biotite–garnet thermometry. Pressures were estimated based on the calculated temperatures, the aluminosilicate stability diagram of Holdaway (1971), and several compositional-based geobarometers (Spear, 1993). Geothermometry data are presented in table 8.

Microprobe analyses were performed on six polished sections of gneiss and one polished section from a gold-bearing vein, using the Cameca SX-50 electron microprobe and Probe for Windows software at the University of Alaska Fairbanks. Silicate compositions were measured using a 10 micron beam at 15 nA on wavelength-dispersive spectrometers. Well-characterized natural and synthetic specimens were employed as standards. On-peak counts were collected for 10 seconds and background counts were collected for 5 seconds. Five points were selected for each silicate. These data were ZAF (atomic mass, absorbance, and fluorescence) corrected and poor-quality results were removed from the data set. Opaque minerals, including gold and bismuth, were identified in the gold-bearing vein using the EDS with a standardless analysis routine. Microprobe analyses are presented in table 9.

Fluid inclusion experiments were performed at the USGS facility in Denver, Colorado, using a Linkam heating/freezing stage cooled with liquid nitrogen. All heating and cooling measurements were computer controlled, with standard-based calibrations performed prior to each session. Chips of a section up to 3 mm^2 were taken from eight doubly-polished sample sections, 100 to 150 microns thick, and analyzed individually. The chips, attached by glue to the slide, were removed from the section using acetone. Heating and cooling measurements were performed using Linksys, a Windows-driven program, which has a precision of 0.1° Celsius. The low-temperature measurements included CO_2 and clathrate melting temperatures. All measurements except for final homogenization were performed systematically on each inclusion before moving on to the next. After several inclusions were measured, final homogenization temperatures were measured for as many inclusions as possible. Final homogenization observations were made for surrounding inclusions where possible. Once stretching of an inclusion was indicated (by non-repeatable heating experiments), no more homogenization measurements were collected from that chip. Fluid inclusion data are presented in tables 10, 11, and 12.

Five samples were dated using the $^{40}Ar/^{39}Ar$ technique, as described in detail by Douglas (1996). The samples were irradiated for 20 megawatt hours in a reactor at McMaster University along with standard sample MMHB-1 with age 513.9 Ma. The standard is used to estimate J, the irradiation parameter and the flux gradient of the reactor. The irradiated samples were then analyzed in the mass spectrometer at the University of Alaska Fairbanks geochronology laboratory, using an $^{40}Ar/^{39}Ar$ step heating routine 39–40 days after irradiation. The measured argon isotopes were corrected for mass discrimination as well as for interference of Ca, K, and Cl produced from the reactor. Blanks (inlets) were

run to determine background levels of argon, and measurements were corrected for the background argon. Ages are quoted with a ±1 sigma level and calculated using the constants of Steiger and Jaeger (1977). Argon dating results are presented in table 13. The proposed geological events for the Richardson area, based on the radiometric dating, are presented in table 14. Table 15 lists the $^{40}Ar/^{39}Ar$ step-heating results and data.

MAJOR CONCLUSIONS TAKEN FROM THE THESIS

1. The Richardson area contains two previously unmapped igneous units: the Gold Run Intrusion and felsic dike swarms. The age and composition of the Gold Run Intrusion is indistinguishable from 'classic' 90 Ma Alaskan volcanic arc-related plutons, the closest of which is the Birch Lake pluton. In contrast, the felsic dikes are fine-grained leucocratic granites with significantly older (~114 Ma) ages with syn-collisional trace-element signatures and a shallow (~0.5 km) depth of emplacement.
2. Geothermobarometric model temperatures and pressures for gneiss samples fall above the geothermal gradient, ranging from 560 to 620ºC and 3–4 kbars, respectively, that contrast with similar temperatures but higher pressures recorded in Fairbanks-area rocks. However, these values do not necessarily require different peak metamorphic conditions. Rather, rocks in the Richardson area apparently experienced a younger recrystallization episode at relatively high temperature and low pressure, possibly related to collisional tectonics.
3. Sericite from the selvage of a gold-bearing quartz vein yielded a $^{40}Ar/^{39}Ar$ interpreted age of ~105 Ma, significantly older than the ~90 Ma event age of the Gold Run Intrusion and those commonly associated with most other gold systems in interior Alaska, including the Democrat Dike. Petrography and fluid inclusion studies indicate that the ore-bearing fluid was highly reduced (methane in fluid inclusions) and had low fS_2 (lack of sulfide minerals in the presence of native bismuth, hedleyite, and gold). Temperature of formation is estimated between 400 and 500ºC. The mineralogy and fluid inclusion chemistry associated with gold deposition is radically different from the younger Democrat lode deposit. The ~105 Ma age suggests a possibility for a genetic relationship between gold mineralization and emplacement of the felsic dikes.

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Table 1. List of grab samples, approximate locations, assigned rock types and analyses. T.S. = thin section, P.S. = polished section, WRA = whole rock analysis, Geotherm = microprobe, geothermobarometric analysis, FI = fluid inclusion study, Ar/Ar = $^{40}Ar/^{39}Ar$ radiometric dating. Blank sample# indicates observations were recorded but no sample was collected. Keys to rock unit abbreviations are listed at end of this table on page 12

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
1	537115	7137230	MTR	0.02						
2	537015	7137040	MTR							
3	537015	7137000	BLG							
4	536900	7136900	MTR							
5	536900	7136900	MI							
6	536875	7136850	MTR							
7	536830	7136780	MI							
8	536940	7136715	MTR							
9	537200	7136920	BLG							
10	537220	7137020	BLG							
11	537400	7137000	MI	0.25						
12	537400	7137050	MI							
14	537100	7137300	MTR							
15	537100	7137600	MTR							
16	537200	7135950	MTR	0.15						
17	537050	7135850	MI	0.14						
17	537050	7135850	MTR							
18	537030	7135830	QFR							
19	537100	7135800	HFL	0.2						
19	537100	7135800	BLG	0.02						
20	537150	7135800	MI							
21	537200	7135700	MTR							
22	537170	7135500	GN							
23	536650	7135830	MTR	0.1						
24	536450	7135650	MTR							
25	536600	7135600	BLG							
26	536630	7134590	MTR	0.11						
27	536850	7135350	MTR	0.15						
28	536950	7135350	GN							
29	537050	7135200	BLG							
30	537100	7135100	MTR	0.12						
31	537200	7135150	BLG	0.15						
32	537750	7135300	MTR	0.14						
33	536590	7136150	MTR							
34	536450	7135900	FGN							
35	536300	7135450	MI	0.12						
36	535650	7134850	SKN	0.18						
37	535450	7134300	QFR	0						
38	535750	7134400	GN							
39	535850	7134450	SCH							
40	536050	7134350	SGN							
41	536050	7134400	GN							
42	536050	7134450	FBQ							
43	536200	7134600	QFR							
44	536200	7134800	GN,HFL							
45	536250	7134850	HFL, GN	0.3,0.15						

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
46	536250	7134850	FGN							
47	536250	7134850	HFL							
48	536200	7134950	QFR							
49	536200	7134950	SGN							
50	536250	7135500	BLG							
51	536300	7135350	MTR							
52	536300	7135150	GN							
53	536300	7135000	INT							
54	536300	7134900	GN	0.03						
55	536330	7134940	GN							
56	536300	7134850	GN							
57	536300	7134780	PEG							
58	536250	7134750	QFR	0.01						
59	536200	7134700	QTZ							
60	536200	7134700	HFL							
61	536300	7134700	FGN							
62	536300	7134600	GN							
63	536500	7134700	GN							
64	536450	7134750	BLG							
65	536050	7135100	AMPH, GN	---,0.15						
66	535950	7135000	SGN							
67	535830	7134975	SGN							
68	535600	7134850	SKN							
69	535450	7134750	SGN	0.2						
70	535450	7134700	SGN							
71	535450	7134450	GGE							
72	535450	7134450	QTZ							
73	535450	7134450	QFT		x		x			
74	535450	7134450	ALT							
75	535500	7134300	ALT							
76	535650	7134250	SGN							
78	535350	7134260	SCH							
79	535000	7134130	PEG							
80	534900	7134250	GN							
81	534800	7134250	GN	0.2	x		x			
82	534650	7134250	SGN	0.06						
83	534350	7134150	SGN	0.15						
84	533800	7134250	GN	0						
85	533800	7134450	MI	0.1						
86	533800	7134550	BLG							
87	533850	7134550	BLG							
88	534000	7134650	BLG							
89	534100	7134850	GN							
90	534100	7134850	BLG							
91	534200	7135200	MI	0.1						
92	534200	7135400	MTR							
93	534150	7135650	MI	0.09						
94	534650	7135950	QFR							
95	534850	7136100	ALT							

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
96	535300	7136450	ALT							
97	535400	7136400	MI	0.12						
98	535750	7136650	MI							
	536000	7136700	BLG							
	536350	7136500	MI							
100	535650	7137300	MI							
101	535550	7137400	MI							
102	535500	7137450	MI							
103	535150	7137900	MI							
104	535000	7138000	MI							
105	534750	7138300	SGN							
106	534750	7138400	BLG							
107	534750	7138500	GN							
	534850	7138550	SGN							
108	534350	7138750	GN							
109	534250	7138700	MI							
110	534250	7138700	SGN							
111	534250	7138750	SGN							
112	529900	7139200	GN		x		x			
113	529900	7139180	GN							
114	528950	7139150	GN							
115	528800	7139050	QFR							
116	528750	7139100	ALT							
117	528750	7139050	FGN							
118	528650	7138950	GN		x	x	x			
119	528500	7138850	ALT							
120	528200	7138750	ALT							
121	528150	7138750	RHY							
122	530250	7139050	GN		x	x		x		
123	530500	7139050	GN		x	x	x			
124	530650	7139000	GN		x		x			
125	530750	7139000	GN+QFR		x		x			x
126	530860	7138960	GN							
127	530860	7138960	AMPH				x			
128	530860	7138960	GN		x		x			
129	531150	7139100	GN				x			
130	531350	7139400	QFR							
131	531350	7139450	GN							
132	531350	7139450	QFR							
	531350	7139450	QFR							
133	531600	7140200	QFR							
	531600	7140200	SGN							
134	531700	7140200	ALT							
	531700	7140200	RHY							
	531700	7140200	FGN							
135	531650	7140250	SGN				x			
136	531750	7140500	QFR							
137	531750	7140500	GN		x		x			
138	531900	7140800	QFR							

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
139	532050	7141000	QFR							
	532350	7140700	QFR							
140	532900	7140450	QFR		x		x			
141	533000	7140400	GN							
	533000	7140400	QFR							
	533000	7140400	PEG							
142	533000	7140400	GN		x		x			
	533050	7140300	QFR							
143	533100	7140350	QFR		x		x			x
144	533100	7140050	GN							
145	533050	7139750	QFR							
146	533050	7139700	QFR							
147	533000	7139350	GN							
148	532750	7139100	QFR							
149	532600	7138950	GN							
150	532600	7138850	GN							
151	532500	7138350	QFR							
152	532350	7138300	GN							
153	532300	7138200	GN							
154	532000	7138200	QFR							
155	531900	7138200	SGN							
156	531500	7138600	AMPH							
157	531650	7137500	GN							
158	531650	7137350	QFR+GN+ AMPH		x,x		x			
159	531200	7136800	SGN							
160	537400	7133650	GN							
161	537350	7134050	SGN							
163	537650	7135500	MTR							
164	537350	7136100	MTR							
165	537550	7136050	BLG							
166	537550	7135900	MTR							
167	537630	7135865	GN							
168	537800	7135830	GN							
169	537900	7135700	GN							
170	537850	7135500	BLG							
171	538000	7135400	MTR							
172	538100	7135250	GN							
173	538050	7135050	MTR							
174	538040	7135000	GN							
175	537750	7134450	QFR							
176	537525	7134300	MI							
177	538300	7138000	MTR							
178	531500	7134500	MI							
179	531550	7134450	GN							
180	531550	7135150	GN							
99GG001	525760	7141860	PEG	-0.03						
99GG002	526100	7142150	MI	-0.02						
99GG003	526900	7145500	QFR	0	x					

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
99GG004	526600	7143900	SGN	0.08						
99GG005	527700	7143350	QFR	0.03						
99GG006	527525	7141700	MI	0.08						
99GG007	527890	7141290	PEG	-0.02						
99GG008	528200	7140040	MI	0.1	x	x				
99GG009	527840	7140035	MI	0.05	x	x				
99GG010	528000	7140000	MI	0.06						
99GG011	527500	7139950	MI	0.06						
99GG012	527350	7139870	MI	0.15						
99GG013	527350	7139800	GN	0.1	x					
99GG014	528200	7140400	GN	0.02						
99GG015	528825	7139670	GN	0.02						
99GG016	528360	7141760	QFR	0.02						
99GG017	528400	7141750	GN	0.06						
99GG018	528410	7141750	MGN	0.12	x	x				
99GG019	528300	7140040	MI	0.1						
99GG020	528400	7141900	QFR	0.02						
99GG021	528460	7140900	MI	-0.2						
99GG022	528200	7141060	QFR	0						
99GG023	528400	7141900	AGN	-0.02						
99GG024	528460	7142640	SGN	0.15	x	x	x			
99GG025	528270	7140760	GN	0.02						
99GG026	528350	7140000	GN	0.05	x					
99GG027	528110	7141060	SGN	0.1						
99GG028	528150	7141340	QTZ	0						
99GG029	528400	7140270	QFR	0						
99GG030	528360	7142050	QFR	0						
99GG031	528490	7140274	GN	0.08	x		x			
99GG032	528110	7141060	ALT	0						
99GG033	528750	7140800	MI	0						
99GG034	528480	7140780	SGN	0.06						
99GG035	528290	7140750	RHY	0						
99GG036	530520	7140200	QFR	-0.02						
99GG037	528400	7141750	QFR	-0.05						
99GG038	528825	7139670	ALT	-0.03						
99GG039	529500	7140700	MTR	0						
99GG040	529050	7139300	GN	0	x	x	x			
99GG041	529550	7140700	QFR	0.04						
99GG042	529800	7137900	MI	-0.02						
99GG043	530500	7140000	GN	0.08	x					
99GG044	529730	7139500	BLG	0.02						
99GG045	529800	7138700	GN	0.01						
99GG046	530850	7139630	AMPH	0.6						
99GG047	530270	7140450	PEG	-0.03						
99GG048	530300	7142000	QFR	0						
99GG049	530725	7138900	QTZ	0						
99GG050	530530	7140230	GN	0						
99GG051	530530	7140230	QFR	0						
99GG052	530775	7138900	QTZ	0						

Table 1 continue. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
99GG053	530350	7140550	AGN	0						
99GG054	531300	7137100	RHY	-0.05						
99GG055	531250	7138700	AMPH	0.25						
99GG056	531375	7137700	QFR	0						
99GG057	531250	7138700	GN	0						
99GG058	531000	7137200	QFR	0						
99GG059	531375	7137700	FGN	0.03						
99GG060	532175	7138100	QFR	0						
99GG061	530300	7140550	FGN	0						
99GG062	530300	7140550	QFR	0						
99GG063	528450	7142660	SKN	0.2						
99GG064	531300	7137700	RHY	0						
99GG065	532150	7137300	QFR	0						
99GG066	532175	7138100	SGN	0.1						
99GG067	528270	7140760	RHY	0.01						
99GG068	535000	7137480	MI	0.06						
99GG069	536630	7137230	MI	0.09						
99GG070	536600	7137700	MI	0.08						
99GG071	536000	7137300	QFR	0						
99GG072	533910	7139100	GN	0.06	x		x			
99GG073	535270	7134050	GN	0.22						
99GG074	534900	7138450	GN	0.05						
99GG075	536100	7137000	MI	0.08						
99GG077	536000	7137750	MTR	0.05						
99GG078	536950	7136200	QFR	0						
99GG079	536100	7137150	MTR	0.03						
99GG080	534100	7139100	QFR	0						
99GG081	536100	7137150	MI	0.08						
99GG082	537200	7135700	QFR	0						
99GG083	537500	7135700	MTR	0.06						
99GG084	537100	7134700	MTR	0.08						
99GG085	534400	7133700	SGN	0.04						
99GG086	537200	7135700	MTR	0.08						
99GG087	537200	7135450	ALT	0						
99GG088	537130	7135730	BLG	0.4						
99GG089	538000	7135600	ALT	0						
99GG090	537300	7133650	MTR	0.09						
99GG091	535350	7133900	QFR	0						
99GG092	536000	7137650	MI	0.06						
99GG093	537200	7134900	GN	0.06						
99GG094	534100	7139100	GN	0.05	x		x			
99GG095	536150	7137100	BLG	1.3						
99GG096	536600	7137130	QFR	0						
99GG097	537200	7136800	MI	0.03						
99GG098	537750	7137400	BLG	0.15						
99GG099	537750	7137400	ALT	0						
99GG100	536200	7137000	MI	0.05						
99GG101	536630	7137230	MI	0.08						
99GG102	536500	7135000	MGN	0.25						

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
99GG103	533850	7133250	GN	0.06						
99GG104	536140	7137090	MI	0						
99GG105	528200	7140050	MI	0.06	x					
99GG106	527350	7139800	MI	0.08	x					
99GG107	533850	7133090	SKN	0.03						
99GG108	530600	7139900	GN	0.1						
99GG109	530600	7139900	QFR	0.02						
99GG110	528000	7141300	AGN	0.02						
99GG111	536200	7137000	BLG	0.1						
Drill hole samples and USGS samples										
77-187 (USGS)	542000	7139000	GN		x			x		
77-452 (USGS)	525000	7143000	GN		x			x		
77-576 (USGS)	526000	7137200	GN		x			x		
BK1-035	536600	7136400	BLG	0.01					x	
BK1-082	536600	7136400	BLG	0.02					x	
BK1-65	536600	7136400	BLG	0.02					x	
BK1-137	536600	7136400	BLG	0.05		x				
BK1-146	536600	7136400	BLG	0.52	x	x				
BK2-012	536830	7135800	BLG						x	
BK2-047	536830	7135800	BLG+VN	0.05					x	x
BK2-65	536830	7135800	BLG	0.27-0.20		x				
BK2-45	536830	7135800	BLG	0.05		x				
BK2-73	536830	7135800	BLG	0.21	x	x				
BK2-98	536830	7135800	BLG	0.01		x				
BK2-131	536830	7135800	BLG	0.01		x				
BK2-135	536830	7135800	BLG	0					x	
BK2-152	536830	7135800	BLG	0.01					x	
BK3-021	536000	7135000	BK dike 1	0	x		x			
BK3-130	536000	7135000	BK dike 2	0.01	x		x			
BK3-142	536000	7135000	GN	0.04				x		
BK4-062	536100	7136100	BLG	0.11	x		x			
BK4-263	536100	7136100	BLG	0.22	x		x			
BK4-99	536100	7136100	BLG	0.08		x				
BK4-160	536100	7136100	BLG	0.17		x				
BK4-146	536100	7136100	BLG	0.2		x				
BK5-65	536900	7135200	BLG	0.07		x				
BK5-98	536900	7135200	BLG	0.04-0.02		x				
BK5-148	536900	7135200	BLG	0.02		x				
BK6-59	536250	7135200	BLG	0.06			x			
BK5-150	536900	7135200	BLG	0.38	x	x	x			
BK6-059	536250	7135200	BLG	0.06-0.14	x	x	x			
BK6-121	536250	7135200	Migmatite leucosome	0			x			
BK6-125	536250	7135200	GN	0.04			x			

Table 1 continued. List of grab samples, approximate locations, assigned rock types and analyses.

Sample#	UTMX	UTMY	Rock type	Mag. Susc. (*10^-3 SI)	T.S.	P.S.	WRA	Geotherm	FI	Ar/Ar
BK6-129	536250	7135200	Migmatite leucosome	0.01			x			
BK6-131	536250	7135200	Migmatite leucosome	0.01			x			
BR1-372	SW Buck		GN		x		x			
BR4-323	SW Buck		GN		x		x			
BR4-328	SW Buck		GN+VN		x				x	x
BR4-334	SW Buck		GN		x		x			
Buckeye Discovery	536330	7134900	Quartz, GN, PEG, AGN		x				x	
GRI-1	528200	7141500	Gold Run Intrusion	0.01	x		x			x
GRI-2	528630	7141175	Gold Run Intrusion	0.01	x		x			
GRI-3	528400	7141350	Gold Run Intrusion	0.01	x		x			

Legend:
MTR, MI, BLG = Bald knob gneiss
GN = undifferentiated gneiss
SKN = marble
QFR = felsic dike
SCH = schistose rock
SGN = schistose gneiss (undifferentiated)
HFL = hornfels
QFT = tourmaline bearing felsic gneiss
ALT = bleached gneissic rock (predominately on Buck Ridge)
RHY = rhyolite
AGN = augen gneiss
PEG = pegmatite
AMPH = amphibolite
QTZ = quartz-rich rock

Table 2. Modal mineralogy of gneisses. Values are visual estimates of percentages from petrographic analysis. UTMX and UTMY are UTM coordinates. Plag=plagioclase, Kspar= K-feldspar, Biot=biotite, Sill=sillimanite, WM=white mica, Gar=garnet, Chl=chlorite, Tr=trace. Buck Ridge coordinates are not known.

Sample	UTMX	UTMY	Quartz	Plag	Kspar	Biot	Opaques	Sill	WM	Gar	Chl
99GG-24	528460	7142640	27	26		20	5	15	12		
122B	530250	7139050	60	20		10	2	4	4		
99GG-106	527350	7139800	50	15	10	18		5	2		
99GG-105	528200	7140050	45	10	19	20		5		1	
99GG-43	530500	7140000	48	10	10	20	1	10	1		
99GG-40	529050	7139300	60	25		14	1				
99GG-31	528490	7140274	60	20		15	1	10			
99GG-26	528350	7140000	50	17	7	15		5		1	
99GG-13	527350	7139800	45	14	5	25	10			1	
99GG-08	528200	7140040	50	17	5	20		5	2	1	
122A	530250	7139050	39	35		20	5			1	
99GG-09	527840	7140035	55	10		20		5	10		
118A	528650	7138950	50	25		13		1	10	1	
99GG-18	528410	7141750	50	15		10	2	2	15		6
123	530500	7139050	65	15		15		4		1	
128	530860	7138960	30	30		19		10	10		1
124B	530650	7139000	60	20		15			5		
124C	530650	7139000	60	20		10		2	10		
137	531750	7140500	60	15		20		5			
81	534800	7134250	62	22		15			1		
142	533000	7140400	65	18		10		1	5	1	
140	532900	7140450	54	23		15		3	5		
99GG-094	534100	7139100	30	45	10	14					1
99GG-072	533910	7139100	25	40	20	13				1	1
122a	530250	7139050	40	40		19				1	
77-187	542000	7139000	50	25	5	15		2	2	1	
77W-452	525000	7143000	50	30		20				1	
BK3-142	536000	7135000	45	25	5	20		4		1	
77-576	526000	7137200	50	28	5	15		2		1	
BK6-059	536250	7135200	40	20	15	17	2	1	5		
BK5-150	536900	7135200	45	20	7	15	3	3	7		
BK4-062	536100	7136100	50	25	5	15	1	5	5		
BK4-263	536100	7136100	40	20	15	15	2	1	5		
BR4-323	SW Buck		55	20		24		1			
BR1-372	SW Buck		50	25		20	2	3			
BR4-334	SW Buck		55	15	15	15		Tr.			

Table 3. Estimated modal mineral abundances (volume %) in felsic dike thin sections.

Sample	Group	Qtz	Plag	Kspar	Tourm	Mica	Point Cnts.
73	1	36	30	32	2		102
143a	1	35	27	34		4	104
125	1	33	27	32		8	109
158a	2	36	34	26		4*	104

Qtz=quartz, Plag=plagioclase, Kspar=K-feldspar, Tourm=tourmaline, Mica=white mica and minor biotite, Point Cnts.= number of points counted, *=biotite altering to chlorite.

Table 4. XRF major oxide and normative values for gneiss samples in the Richardson study area. An=anorthite, Q=quartz, or=orthoclase, ab=albite, C=corundum, hy=hypersthene, mt=magnetite, il=ilmenite, hem=hematite, ap=apatite.

Sample	118A	112A	123	128	124B	124C	137	140	142	81	99GG094
SiO2	71.4	81.28	85.4	60.18	83.66	73.76	65.98	69.93	84.07	78.42	71.81
TiO2	0.55	0.31	0.25	0.77	0.24	0.53	0.67	0.68	0.18	0.4	0.28
Al2O3	13.77	9.23	6.34	20.34	7.39	12.05	16.75	14.99	7.29	9.59	14.36
Fe2O3	3.94	2.54	2.13	6.71	2.25	4.88	5.21	5.87	2.55	3.46	3.08
MnO	0.06	0.04	0.04	0.07	0.03	0.05	0.04	0.09	0.03	0.04	0.07
MgO	1.35	0.78	0.5	2.27	0.53	1.59	1.82	1.77	0.64	1.25	0.7
CaO	2.68	0.56	0.57	0.56	0.71	0.56	0.46	0.61	0.92	1.11	2.53
Na2O	3.22	1.13	1.08	1.23	1.54	1.23	1.24	0.63	1.49	1.7	3.08
K2O	1.35	1.91	0.99	3.92	1.33	2.82	3.84	2.91	1.13	2.5	2.75
P2O5	0.05	0.07	0.05	0.09	0.04	0.07	0.08	0.09	0.08	0.08	0.09
LOI	0.8	1.16	0.76	3.45	0.81	1.42	2.72	1.85	0.79	0.75	0.84
Total	99.2	99.02	98.14	99.61	98.56	99	98.82	99.44	99.21	99.33	99.62
%AN	32.25	19.53	21.49	17.38	20.02	18.23	14.36	31.38	24.27	25.73	31.46
Q	39.61	65.24	73.51	31.73	67.42	51.42	39.6	49.92	68.38	54.76	37.01
or	7.98	11.29	5.85	23.17	7.86	16.67	22.69	17.2	6.68	14.77	16.25
ab	27.25	9.56	9.14	10.41	13.03	10.41	10.49	5.33	12.61	14.39	26.06
an	12.97	2.32	2.5	2.19	3.26	2.32	1.76	2.44	4.04	4.98	11.96
C	2.26	4.45	2.58	13.27	2.22	6.12	9.91	9.91	2.13	2.26	1.93
hy	4	1.94	1.25	9.97	1.32	6.21	6.73	7.75	1.59	3.54	2.09
mt	2.97	1.35	0.51	3.29	0.88	2.94	3.15	3.16	2.1	2.75	2.58
il	1.04	0.59	0.47	1.46	0.46	1.01	1.27	1.29	0.34	0.76	0.53
hem	0	0.88	1.4	0	1.13	0	0	0	0.23	0	0
ap	0.12	0.16	0.12	0.21	0.09	0.16	0.19	0.21	0.19	0.19	0.21

Table 4 continued. XRF major oxide and normative values for gneiss samples in the Richardson study area.

Sample	99GG072	99GG024	99GG031	99GG040	BK004-062	BK004-263	BK005-150	BK006-059	BR1-372	BR4-323	BR4-334
SiO2	70.92	55.15	73.96	85.21	69.13	69.92	70.5	69.56	73.64	71.4	71.51
TiO2	0.27	1.13	0.58	0.24	0.77	0.84	0.79	0.57	0.53	0.62	0.58
Al2O3	14.5	23.92	12.82	6.44	14.46	14	14.68	14.05	13.23	14.69	14.08
Fe2O3	2.95	7.84	4.84	2.28	5.55	5.09	6.5	4.64	4.52	5.37	4.37
MnO	0.06	0.15	0.07	0.05	0.04	0.05	0.07	0.06	0.07	0.06	0.05
MgO	0.64	2.86	1.49	0.52	1.74	1.55	1.98	1.51	1.35	1.69	1.47
CaO	2.62	0.76	0.81	0.76	1.39	1.24	0.6	1.13	0.87	0.67	0.83
Na2O	2.64	1.47	1.19	1.54	1.3	1.34	0.75	1.62	0.97	0.9	1.21
K2O	3.84	3.98	2.33	0.85	3.46	3.8	2.12	3.48	2.57	2.96	3.41
P2O5	0.09	0.09	0.08	0.06	0.09	0.1	0.08	0.1	0.09	0.09	0.11
LOI	0.66	1.95	1.28	0.74	1.46	1.2	1.72	1.45	1.86	1.64	1.07
Total	99.21	99.33	99.48	98.72	99.39	99.13	99.79	98.17	99.7	100.09	98.69
%AN	35.71	20.37	25.77	20.59	36.44	32.66	27.88	26.54	31.23	26.43	24.92
Q	34.49	23.52	53.48	70.77	41.94	42.3	52.25	41.66	53.77	49.91	47.22
or	22.69	23.52	13.77	5.02	20.45	22.46	12.53	20.57	15.19	17.49	20.15
ab	22.34	12.44	10.07	13.03	11	11.34	6.35	13.71	8.21	7.62	10.24
an	12.41	3.18	3.5	3.38	6.31	5.5	2.45	4.95	3.73	2.74	3.4
C	1.45	16.03	7.06	1.75	6.26	5.67	10.25	5.8	7.49	9	7.15
hy	1.75	11.97	5.73	1.3	6.68	5.18	8.82	5.47	5.05	6.92	4.86
mt	2.57	3.81	3.02	1.03	3.29	3.39	3.32	3	2.94	3.07	3.02
il	0.51	2.15	1.1	0.46	1.46	1.6	1.5	1.08	1.01	1.18	1.1
hem	0	0	0	1.03	0	0	0	0	0	0	0
ap	0.21	0.21	0.19	0.14	0.21	0.23	0.19	0.23	0.21	0.21	0.25

Table 5. XRF major and minor element results for amphibolite samples 127 and 158B. Oxides are shown in percent and trace elements are in ppm.

Samples	127	158B
SiO2	44.87	39.4
TiO2	4.05	5.77
Al2O3	5.94	10.84
Fe2O3	13.3	15.04
MnO	0.29	0.28
MgO	15.74	8.02
CaO	11.57	13.41
Na2O	0.6	0.5
K2O	0.17	0.75
P2O5	0.77	2.22
LOI	1.61	3.14
Total	99.06	99.46
Ba	228	119
Sr	159	164
Y	18	34
Nb	65	92
Zr	241	336
Rb	12	21

Table 6. XRF major oxide and normative values in percent (%) for igneous rock samples in the Richardson study area. Norm abbreviations are the same as for table 4. *Sample BK3-125 shown for comparison to adjacent migmatite leucosomes.

Sample	73	125	158	129	135	143	BK003-021	BK003-130
Rock type	Felsic dike	Felsic dike	Felsic dike	Felsic dike	Felsic dike	Felsic dike	Course dike	Course dike
SiO2	74.97	74.93	74.67	72.39	74.64	73.75	73.18	69.21
TiO2	0.03	0.08	0.09	0.08	0.05	0.04	0.03	0.14
Al2O3	14.23	14.18	14.34	13.94	14.4	14.22	15.59	15.98
Fe2O3	0.89	0.61	0.72	1.21	0.6	0.96	0.43	1.15
MnO	0.08	0.02	0.01	0.01	0	0.02	0	0.02
MgO	0.11	0.22	0.28	0.19	0.11	0.09	0.14	0.28
CaO	0.42	0.52	1.38	0.46	0.46	0.67	2.15	1.57
Na2O	3.4	2.88	3.79	2.78	2.45	3.35	3.23	2.34
K2O	4.17	4.99	3.39	4.3	4.43	4.34	5.09	7.6
P2O5	0.17	0.14	0.1	0.1	0.06	0.2	0.07	0.54
LOI	0.79	0.85	0.75	2.54	1.74	1.08	0.4	0.71
Total	99.26	99.42	99.52	98	98.94	98.72	100.31	99.54
%AN	3.27	6.4	16.18	6.48	8.36	6.64	27.19	17.71
Q	38.65	38.04	36.56	38.78	42.46	36.65	30.3	24.26
or	24.64	29.49	20.03	25.41	26.18	25.65	30.08	44.91
ab	28.77	24.37	32.07	23.52	20.73	28.35	27.33	19.8
an	0.97	1.67	6.19	1.63	1.89	2.02	10.21	4.26
C	3.77	3.43	2.17	4.12	4.88	3.27	1.03	2.34
hy	0.27	0.55	0.7	0.47	0.27	0.22	0.35	0.7
mt	0.17	0	0	0	0	0	-0.02	0.04
il	0.06	0.04	0.02	0	0	0	0.43	1.15
hem	0.77	0.61	0.72	1.21	0.6	0.96	0.16	1.25
ap	0.39	0.32	0.23	0.23	0.14	0.46	0.04	0.12
ru	0	0.06	0.08	0.1	0.07	0.04	0	0

Table 6 continued. XRF major oxide and normative values in percent (%) for igneous rock samples in the Richardson study area.

Sample	GRI-1	GRI-2	GRI-3	BK6-128	BK6-131	BK6-121	BK3-125
Rock type	**Gold Run**	**Gold Run**	**Gold Run**	**Migmatite**	**Migmatite**	**Migmatite**	**Gneiss***
SiO2	71.4	72	71.54	73.01	74.01	73.01	71.07
TiO2	0.28	0.28	0.25	0.03	0.14	0.09	0.6
Al2O3	14.69	14.27	14.36	14.84	13.96	14.67	13.08
Fe2O3	2.66	2.28	2.6	0.87	0.95	1.05	4.3
MnO	0.05	0.04	0.04	0.02	0	0.01	0.07
MgO	0.66	0.6	0.59	0.4	0.41	0.42	1.47
CaO	2.2	1.85	1.92	1.15	0.9	0.81	1.2
Na2O	3.06	3.07	2.98	1.86	1.79	1.91	1.89
K2O	4.57	4.49	4.67	6.04	5.91	6.19	4.7
P2O5	0.11	0.15	0.11	0.23	0.08	0.08	0.1
LOI	0.48	0.53	0.71	1.31	1.52	1.18	1.01
Total	100.16	99.56	99.77	99.76	99.68	99.42	99.52
%AN	28.25	23.99	25.88	21.07	20.65	17.78	24.89
Q	30.73	32.53	31.65	36.67	38.67	36.08	37.14
or	27.01	26.53	27.6	35.69	34.93	36.58	27.78
ab	25.89	25.98	25.22	15.74	15.15	16.16	15.99
an	10.2	8.2	8.81	4.2	3.94	3.5	5.3
C	0.97	1.36	1.18	3.7	3.17	3.55	2.94
hy	1.64	1.49	1.47	1	1.02	1.05	4.7
mt	1.9	0.77	1.87	0	0	0	3.04
il	0.53	0.53	0.47	0.04	0	0.02	1.14
hem	0.47	1.25	0.46	0.87	0.95	1.05	0
ap	0.25	0.35	0.25	0.53	0.19	0.19	0.23
ru	0	0	0	0.01	0.15	0.08	0

Table 7. Trace element compositions (in ppm) of igneous rocks from the Richardson study area.

Sample	Unit	Ba	Nb	Rb	Sr	Y	Zr	Nb+Y
GRI-3	Gold Run Intrusion	1319	15	204	329	24	146	39
GRI-1	Gold Run Intrusion	1194	15	201	311	25	143	40
GRI-2	Gold Run Intrusion	1200	14	203	314	22	145	36
BK3-021	BK dike 1	1284	3	103	299	10	62	13
BK3-130	BK dike 2	2013	6	184	364	31	29	37
125	Felsic dike	487	5	113	136	15	41	20
158	Felsic dike	1763	5	68	402	14	34	19
73	Felsic dike	236	30	298	33	18	28	48
129	Altered felsic dike	372	12	133	133	21	47	33
135	Altered felsic dike	239	22	159	119	19	44	41
143	Felsic dike	201	25	263	53	17	39	42
BK6-121	Migmatite leucosome	1824	3	140	313	15	102	18
BK6-129	Migmatite leucosome	1630	1	134	299	16	56	17
BK6-131	Migmatite leucosome	1470	5	139	273	23	56	28

Table 8. Samples employed for Geothermometry and Geobarometry from Richardson field area.

Sample	UTMY	UTMX	Fault Block	Mineral assemblage present	Geobarometer(s) employed	Temp Est. (^{o}C)
77-187	7139000	542000	NE	Quartz-plagioclase-bio-musc-sillimanite-garnet	1,2,3,4,5	610,555
BK3-142	7135000	536000	E	Quartz-plagioclase-biotite-sillimanite-garnet	1	620
122a	7139050	530250	W	Quartz-plagioclase-biotite-garnet	1	580
77-576	7137200	526000	S	Quartz-plagioclase-biotite-sillimanite-garnet	1	555
77-452	7143000	525000	NW	Quartz-plagioclase-biotite-garnet	2,3	560

Geobarometers: 1=garnet-sillimanite-plagioclase-quartz (Hodges and Spear, 1982; Hodges and Crowley, 1985; Newton and Haselton, 1981; Ganguly and Saxena, 1984), 2=garnet-muscovite-plagioclase-biotite (Hodges and Crowley, 1985; Ghent and Stout, 1981; Hoisch, 1990), 3=garnet-muscovite-plagioclase-quartz (Hoisch, 1990), 4=garnet-muscovite-sillimanite-quartz (Hodges and Crowley, 1985), 5=garnet-muscovite-biotite-sillimanite (Hodges and Crowley, 1985).

Table 9. Average microprobe data of mineral assemblages for geothermobarometric calculations.

sample	452c-1	452c-1	452c-2	452c-2	452c-2	452c-2	77187-1	77187-1	77187-1	77187-2	77187-2	77187-2	77187-2
mineral	g	b	g	h	wm	p	g	p	b	p	g	b	wm
Na2O	0.05	0.11	0.03	0.07	1.01	9.49	0.05	7.94	0.13	7.78	0.02	0.14	0.61
MgO	2.46	8.77	2.57	7.90	0.51	0.00	1.90	0.01	6.20	0.00	1.55	6.74	0.54
Al2O3	21.74	19.71	22.02	20.68	36.39	23.29	21.70	24.87	21.12	25.57	21.66	21.61	37.39
SiO2	36.83	34.26	37.07	35.23	43.62	63.85	36.80	61.26	33.93	60.23	36.79	34.53	45.08
K2O	0.05	8.91	0.01	8.36	9.58	0.15	0.01	0.35	8.76	0.25	0.02	8.84	10.32
CaO	1.19	0.05	1.30	0.09	0.02	3.33	1.62	5.37	0.05	5.98	1.49	0.04	0.05
TiO2	0.04	1.75	0.05	1.10	0.31	0.07	0.02	0.01	1.67	0.07	0.00	1.40	0.19
FeO	32.06	19.30	33.49	19.90	1.18	0.01	30.37	0.03	21.38	0.06	28.57	20.26	1.12
MnO	6.09	0.18	4.20	0.16	0.04	0.02	8.43	0.01	0.42	0.01	10.32	0.48	0.08
H2Oc		3.85		3.89	4.38				3.84			3.88	4.51
Total	100.50	96.89	100.72	97.36	97.05	100.21	100.89	99.84	97.50	99.95	100.43	97.91	99.90
cations per formula unit													
Na	0.01	0.03	0.00	0.02	0.27	1.62	0.01	1.37	0.04	1.34	0.00	0.04	0.16
Mg	0.30	2.04	0.31	1.82	0.10	0.00	0.23	0.00	1.44	0.00	0.19	1.55	0.11
Al	2.06	3.62	2.08	3.76	5.86	2.41	2.06	2.60	3.89	2.68	2.06	3.93	5.85
Si	2.96	5.34	2.97	5.43	5.96	5.62	2.96	5.44	5.29	5.36	2.97	5.33	5.99
K	0.00	1.77	0.00	1.64	1.67	0.02	0.00	0.04	1.74	0.03	0.00	1.74	1.75
Ca	0.10	0.01	0.11	0.01	0.00	0.31	0.14	0.51	0.01	0.57	0.13	0.01	0.01
Ti	0.00	0.20	0.00	0.13	0.03	0.00	0.00	0.00	0.20	0.00	0.00	0.16	0.02
Fe	2.16	2.51	2.24	2.57	0.14	0.00	2.04	0.00	2.79	0.00	1.93	2.61	0.12
Mn	0.41	0.02	0.28	0.02	0.00	0.00	0.57	0.00	0.06	0.00	0.71	0.06	0.01
Ca site tot	2.97		2.95			1.93	2.99	1.88		1.91	2.95		
O	12.00	22.00	12.00	22.00	22.00	16.00	12.00	16.00	22.00	16.00	12.00	22.00	22.00
Fe/Mg	7.30	1.23	7.32	1.14			8.95		1.93		10.20	1.69	
% An						16		27		30			
-lnKb-g	1.78		1.64				1.53				1.81		
avg T,P	570C, 2.7 kb		590C, 4.2 kb				605C, 3.6 kb			560C, 3.2 kb			

See text for analytical methods. H2Oc=calculated water content; Ca site tot= # cations in site containing Ca; O=total oxygen per formula unit; T,P from techniques described in text; b=biotite, g=garnet, h=hornblende, p=plagioclase, wm=white mica, -lnKb-g= negative log of (biotite)-Fe/Mg cations (garnet).

Table 9 continued. Average microprobe data of mineral assemblages for geothermobarometric calculations.

sample	BK3-142-1	BK3-142-1	BK3-142-1	BK3-142-2	BK3- 142-2	BK3-142-2	77-576-1	77-576-1	77-576-1	77-576-2	77-576-2
mineral	g	b	p	g	b	p	g	b	p	g	b
Na2O	0.04	0.09	7.51	0.05	0.14	6.62	0.05	0.19	8.29	0.04	0.15
MgO	2.42	7.18	0.01	2.21	6.92	0.01	2.14	7.99	0.01	2.38	7.96
Al203	22.07	19.85	25.93	21.72	19.85	27.63	21.73	21.25	24.93	21.70	21.78
SiO2	37.24	34.01	59.40	36.66	33.79	57.52	36.86	34.30	60.77	36.74	34.47
K2O	0.01	9.40	0.38	0.03	9.65	0.20	0.05	9.49	0.33	0.04	9.78
CaO	1.38	0.06	6.57	1.20	0.03	8.18	0.94	0.01	5.27	1.13	0.01
TiO2	0.03	2.43	0.02	0.05	2.64	0.02	0.00	1.88	0.05	0.06	1.29
FeO	30.88	20.87	0.03	30.34	21.68	0.08	30.48	19.16	0.07	30.19	19.00
MnO	7.42	0.33	0.03	8.19	0.41	0.05	8.86	0.19	0.04	7.92	0.23
H2Oc		3.85			3.86			3.90			3.91
Total	101.51	98.08	99.88	100.45	98.99	100.30	101.10	98.37	99.76	100.21	98.59
cations per formula unit											
Na	0.01	0.03	1.30	0.01	0.04	1.15	0.01	0.06	1.43	0.01	0.05
Mg	0.29	1.66	0.00	0.27	1.60	0.00	0.26	1.83	0.00	0.29	1.82
Al	2.07	3.64	2.73	2.06	3.63	2.90	2.06	3.84	2.62	2.06	3.93
Si	2.96	5.29	5.30	2.96	5.24	5.13	2.96	5.26	5.41	2.96	5.28
K	0.00	1.87	0.04	0.00	1.91	0.02	0.00	1.86	0.04	0.00	1.91
Ca	0.12	0.01	0.63	0.10	0.01	0.78	0.08	0.00	0.50	0.10	0.00
Ti	0.00	0.28	0.00	0.00	0.31	0.00	0.00	0.22	0.00	0.00	0.15
Fe	2.06	2.72	0.00	2.05	2.81	0.01	2.05	2.46	0.01	2.04	2.43
Mn	0.50	0.04	0.00	0.56	0.05	0.00	0.60	0.02	0.00	0.54	0.03
Ca site tot	2.96		1.93	2.98		1.93	2.99		1.93	2.97	
O	12.00	22.00	16.00	12.00	22.00	16.00	12.00	22.00	16.00	12.00	22.00
Fe/Mg	7.15	1.63		7.71	1.76		8.01	1.35		7.12	1.34
% An			33			41			26		
-lnKb-g	1.48			1.48			1.78			1.67	
avg T,P	620C, 3.6 kb			615C, 2.4 kb			565C, 2.8 kb			580C, 3.2 kb	

Table 9 continued. Average microprobe data of mineral assemblages for geothermobarometric calculations.

sample	122a-1	122a-1	122a-1	122a-2	122a-2	122a-2
mineral	g	b	p	p	g	b
Na2O	0.02	0.14	8.04	7.81	0.04	0.16
MgO	2.17	7.68	0.00	0.00	2.07	8.08
Al2O3	21.41	19.68	25.16	25.54	21.77	18.94
SiO2	36.18	34.17	59.92	59.26	36.75	33.55
K2O	0.02	9.06	0.16	0.16	0.00	8.91
CaO	1.15	0.03	5.65	6.32	1.33	0.08
TiO2	0.06	2.63	0.01	0.02	0.09	2.72
FeO	28.30	19.33	0.14	0.08	27.85	19.31
MnO	8.33	0.21	0.05	0.01	9.87	0.26
H20c		3.84				3.79
Total	97.64	96.76	99.14	99.20	99.77	95.80
cations per formula unit						
Na	0.00	0.04	1.40	1.36	0.01	0.05
Mg	0.27	1.79	0.00	0.00	0.25	1.91
Al	2.08	3.62	2.66	2.70	2.08	3.53
Si	2.98	5.34	5.37	5.32	2.97	5.31
K	0.00	1.80	0.02	0.02	0.00	1.80
Ca	0.10	0.01	0.54	0.61	0.12	0.01
Ti	0.00	0.31	0.00	0.00	0.01	0.32
Fe	1.95	2.52	0.01	0.01	1.88	2.56
Mn	0.58	0.03	0.00	0.00	0.68	0.04
Ca site tot	2.91		1.94	1.97	2.93	
O	12.00	22.00	16.00	16.00	12.00	22.00
Fe/Mg	7.31	1.41			7.54	1.34
% An			28	31		
-lnKb-g	1.64				1.73	
avg T,P	585C, 3 kb			570C, 3.2 kb		

Table 10. Fluid inclusion samples, locations, and assay values of sampled interval.

Slide (JGA-)	site	UTM E	UTM N	Au Assay value (ppm)	Gold Group
11	BK2-047 (AuVn)	7135800	536830	>1	3 (high Au)
15	BK2-152 (s15)	7135800	536830	0.115	3 (high Au)
2	BK1-65	7136400	536600	.040	2 (interm. Au)
1	BK1-035	7136400	536600	0.095	2 (interm. Au)
4	BK1-082	7136400	536600	<0.02	1 (Au not detected)
12	BK2-012	7135800	536830	<0.02	1 (Au not detected)
13	BK2-135	7135800	536830	<0.02	1 (Au not detected)
B3	Buckeye Discovery (Buckeye)	7134900	536330	up to 53	4 (Discovery high Au)

Table 11. Fluid inclusion data and estimated fluid parameters.

Hole	Slide	Inclusion	CO2	Clath	Cohom	Homog	Au group	Volume	Bars	Density	MoleH20	Est. Press
1	1	2	-60.2	12.4		336	3	40				
1	1	3	-62.3	13.3		325	3	25				
1	1	4	-61.5	12.6		320	3	30				
1	1	5	-58.3	12.5		335	3	45				
1	1	6	-61.5	13.6		325	3	50				
1	1	7	-57.3	10.9		320	3	60				
1	1	8	-62.9	14.2		325	3	35				
1	2	1	-58.7	10.6		270	2	30				
1	2	2	-57.5	11		350	2	45				
1	2	3	-58.6	12.7		310	2	35				
1	2	4	-57.5	11.5		350	2	40				
1	2	5	-57.8	11		340	2	40				
1	2	6	-57.5	10.6	23		2	40	70	0.2	92	200 Bars
1	4	1	-56.6	10.9			3	45				
1	4	2	-56.6	10.4	27	340	3	45	70	0.23	90	200 Bars
1	4	3	-56.7	10.8		330	3	40				
1	4	4	-57	10.6		335	3	30				
1	4	5	-56.9	10.9		330	3	30				
2	11	1	-57.3	10.9		330	1	40				
2	11	2	-57.5	10.8	25.9		1	30	70	0.22	85	200 Bars
2	11	3	-57.8	11.8	25.2		1	25	70	0.22	95	200 Bars
2	11	4	-57.6	10.9	25*		1	45	150	0.78	82	>1 kbar

* = CO2 homogenized to liquid **=critical value

Calculations are based on procedures discussed in Roedder (1984).

CO2=Melting temperature of carbon dioxide in degree Celsius; Clath=Clathrate melting temperature in degree Celsius; Cohom=Partial homogenization of carbonic phase in degree Celsius; Homog=Total homogenization of carbonic phase in degree Celsius; Volume=Volume of vapor within inclusion shown in percent; Bars=Fluid inclusion pressure in bars after Angus and others, 1976; Density=CO2 density of the inclusion after Burress, 1981; MoleH2O=Calculated mole percent of H2O in inclusion fluids; Est. Press=Estimated minimum pressure at time of inclusion formation in bars. Employed P-T density isochores from Kennedy, 1954 and diagrams from Brown and Lamb, 1989.

Table 11 continued. Fluid inclusion data and estimated fluid parameters.

Hole	Slide	Inclusion	CO2	Clath	Cohom	Homog	Au group	Volume	Bars	Density	Moleh20	Est. Press
2	11	5	-57.4	10.8	26.9*	280	1	50	150	0.76	80	> 1 kbar
2	11	6	-61.4	11.1			1					
2	11	7	-58	11.5		330	1	40				
2	11	8	-56.8	11.2		320	1	25				
2	11	9	-58	11.7		325	1	30				
2	11	10	-59.1	10.6		315	1	40				
2	11	11	-58.1	11			1	30				
2	11	12	-57	10.9		325	1	30				
2	11	13	-57	11.2		310	1	20				
2	11	14	-57	10.4		310	1	25				
2	11	15	-57.6	11.7		310	1	35				
2	11	16	-59.6	13.1		295	1					
2	12	1	-58	11.8	19		3	50	65	0.17	90	200 Bars
2	12	2	-57.5	11.6	23	330	3	75	70	0.2	75	200 Bars
2	12	3	-61.6	13.5		345	3	40				
2	13	1	-58.8	12.9		320	3	20				
2	13	2	-57	10.7	24.5	293	3	20	75	0.22	95	200 Bars
2	15	1	-57.6	11.7			1	15				
2	15	2	-57	10.8	26.5	319**	1	40	75	0.23	93	200 Bars
2	15	3	-57	10.9	27	312.5	1	30	75	0.23	94	200 Bars
2	15	4	-57	10.8			1	35				
2	15	5	-56.6	10.7		310	1					
2	15	6	-56.7	10.8	26.6		1	40	75	0.23	95	200 Bars
2	15	9	-57	10.8	30		1	20	80	0.3	95	200 Bars
2	15	10	-57	10.8			1	15				
2	15	11	-56.6	10.3	29	300	1	30	75	0.25	92	200 Bars
2	15	12	-56.6	10.5		305	1	20				
2	15	13	-56.8	10.9	28.5*		1	35	120	0.75	82	>800 bars
Buckeye		1	-65	15.6		335		60				
Buckeye		2	-61.9	13.9				50				

Table 11 continued. Fluid inclusion data and estimated fluid parameters.

Hole	Slide	Inclusion	CO2	Clath	Cohom	Homog	Au group	Volume	Bars	Density	Moleh20	Est. Press
Buckeye		3	-57.6			330		50				
Buckeye		4	-57.5	10.1		330		60				
Buckeye		5	-56.7	10.1		340		50				
Buckeye		6	61.7	13.3		335		35				
Buckeye		7	-58.6	12.2	16.2	337		35	50	0.17	94	200 Bars
Buckeye		8	-57.6	11.0	21.7	330		35	60	0.19	95	200 Bars
Buckeye		9	-58.2	10.9	22.0	325		50	60	0.19	90	200 Bars
Buckeye		10	-57.4	11.0	23.9	325		35	68	0.2	94	200 Bars
Buckeye		11	-65.4	14.1		350		60				

Table 12. Comparison between Bald Knob, Democrat, Ryan Lode fluid inclusion data.

Sample	Size (μ)	TmCO2 (°C)	Clathrate T. (°C)	Th (°C)	Volume % vapor	Salinity (% NaCl)	Mol % CO2	Trap P (bars)
Demo 1	20-60	-56.6	not measured	340-360	10-90	32-65	Variable	unknown
Demo 2	50-100	-56.6	not measured	155-165	10-90	8-11.7	Variable	unknown
BK hiP	10-20	-56.8-57.6	10.9	≥280	35-50	Low	20	>1000
BK loP	10-20	-56.6-62.9	10.4-13.6	300-345	25-50	Low	10 avg	250-400
Ryan Lode	5-35	-56.6 to -58.4	9.3-12.5	206-325	10-90	Low	12	250-300
Bkeyel	10-20	-61 to -65.4	not measured	330-350	50-60	Low?	unknown	unknown
Bkeye2	10-20	-57 to -65.4	10-15.5	325-337	35-50	Low	5-10%	250

Demo 1, Demo 2 = Democrat (Pakhomova et al., 1995); BKhiP, BKloP = Bald Knob, high Pressure and low Pressure types (this study); Ryan Lode = Ryan Lode deposit, Fairbanks district (McCoy et al., 1997); Bkeye1,2 = Buckeye high grade vein (this study).

Table 13. Interpreted $^{40}Ar/^{39}Ar$ ages (in Ma) for Richardson area samples.

Sample number (mineral)	Low-temp fraction(s) age (% Ar)	High-temp fraction(s) age (% Ar)	Plateau age (% Ar)	Interpreted age
125 (WM)	87 ± 32 (1.5%)	104.6 ± 1.6 (11.6%)	102.0 ± 0.5 (81.4%)	>105 Ma
143 (B)	80.5 ± 1.6 (19%)	114.0 ± 9 (1.0%)	92.2 ± 0.6 (76%)	114 ± 9 Ma
GRI-1 (B)	56.9 ± 3.3 (0.6%)	91.6 ± 1.7 (6.5%)	90.7 ± 0.9 (78.3%)	92 ± 2 Ma
AuVn (WM)	excess Ar	105.6 + 1.8 (1.4%)	104.8 ± 1.0 (51.4%)	~ 105 Ma
BR4-328 (WM)	77.5 + 1.1 (5.9%)	96.6 ± 8.7 (0.8%)	84.3 ± 0.5 (82.2%)	85Ma<age< 97Ma

(B) = biotite; (WM) = White mica; (%Ar) = % total ^{39}Ar released in the fraction(s). Spectrometer data in table 15.

Table 14. Ages of geologic events in the Richardson area as suggested by radiometric dating.

Event	Interpreted age	Evidence
Cooling from peak metamorphism	~ 116 Ma	K-Ar age of hornblende from amphibolite (Bundtzen and Reger, 1977)
Emplacement of peraluminous felsic dikes following a collisional event	~ 114 Ma	Highest-temperature fraction age of sample 143; regional correlations
First Gold veining event	~ 105 Ma	Sample AuVn; regional correlations
Subduction-related magmatism	~ 92 Ma	GRI-1 spectrum; regional correlations
Second Gold veining event	~ 90 Ma	Democrat lode deposit age; regional correlations
Early Tertiary magmatism	~ 57 Ma	Post-90 Ma thermal resets to most spectra, especially GRI-1

Table 15. $^{40}Ar/^{39}Ar$ step-heating results and data.

NOTES:
Weighted average J (irradiation parameter) calculated from standard MMhb-1 (513.9 Ma)
Runs are step heat analyses of 1-3 single crystals of a mineral phase.
Laser power (in milliwatts) is the heating step from a defocussed argon-ion laser: 8700 mW represents the fusion step in most cases
% 39Ar: the proportion of 39Ar released in each step of a run.
Measured isotopic ratios (and 1-sigma error) are corrected for reactor induced interferences and decay of 37Ar and 39Ar
% Atm. 40Ar*: percent of atmospheric 40Ar in the sample assuming an initial 40Ar/36Ar ratio of 295.5
40Ar*/39ArK (40*/39K) and ages (and 1-sigma error) calculated using the equations and constants quoted in McDougall and Harrison (1988)

UAF084-55 BR4-328 WM 02-14-01 RICHARDSON Weighted average of J from standards = 0.001380 +/- 0.000006

Laser Power	Fraction 39Ar	40Ar/39Ar measured	+/-	37Ar/39Ar measured	+/-	36Ar/39Ar measured	+/-	% Atm. 40Ar*	Ca/K	Cl/K	40*/39K	Age (Ma)	+/- (Ma)
0	0.059	40.506	0.366	-0.0012	0.0033	0.0294	0.0013	21.4	-0.002	0.0004	31.80	77.5	1.1
150	0.098	33.700	0.229	-0.0016	0.0057	0.0012	0.0015	1.1	-0.003	-0.0003	33.31	81.1	1.2
200	0.159	33.581	0.227	0.0020	0.0059	-0.0010	0.0021	-0.9	0.004	-0.0002	33.84	82.4	1.6
300	0.260	33.915	0.272	-0.0028	0.0016	-0.0002	0.0005	-0.2	-0.005	0.0002	33.95	82.6	0.7
600	0.518	35.631	0.204	-0.0004	0.0011	0.0014	0.0005	1.1	-0.001	0.0004	35.20	85.6	0.6
750	0.691	35.324	0.195	0.0005	0.0015	0.0009	0.0005	0.8	0.001	0.0004	35.02	85.2	0.6
900	0.748	34.413	0.266	0.0032	0.0054	0.0013	0.0017	1.1	0.006	0.0000	33.99	82.7	1.4
1050	0.792	35.069	0.158	-0.0005	0.0056	0.0014	0.0017	1.2	-0.001	0.0001	34.63	84.2	1.2
1200	0.837	35.506	0.175	0.0084	0.0046	0.0025	0.0018	2.1	0.015	0.0004	34.74	84.5	1.3
1350	0.877	35.117	0.260	-0.0033	0.0044	0.0023	0.0019	2.0	-0.006	0.0004	34.40	83.7	1.5
1500	0.920	34.083	0.254	-0.0011	0.0049	0.0004	0.0016	0.3	-0.002	0.0008	33.95	82.6	1.3
2000	0.984	32.664	0.334	0.0066	0.0028	0.0015	0.0013	1.4	0.012	0.0007	32.18	78.4	1.2
2500	0.992	37.260	0.794	0.0219	0.0180	0.0040	0.0100	3.2	0.040	0.0020	36.05	87.6	7.2
3000	0.997	40.401	0.751	-0.0388	0.0236	-0.0005	0.0116	-0.4	-0.071	0.0018	40.52	98.2	8.3
8000	1.000	42.068	2.344	0.0005	0.0743	0.0119	0.0279	8.4	0.001	0.0018	38.52	93.5	20.1
Integrated		35.170	0.080	0.0004	0.0009	0.0027	0.0003	2.3	0.001	0.0003	34.34	83.5	0.5

Table 15 continued. $^{40}Ar/^{39}Ar$ step-heating results and data.

UAF084-54 AuVn WM 02-13-01 RICHARDSON Weighted average of J from standards = 0.001380 +/-0.000006

Laser Power	Fraction 39Ar	40Ar/39Ar measured	+/-	37Ar/39Ar measured	+/-	36Ar/39Ar measured	+/-	% Atm. 40Ar*	Ca/K	Cl/K	40*/39K	Age (Ma)	+/- (Ma)
100	0.014	48.057	0.453	0.0091	0.0040	0.1409	0.0041	86.7	0.017	0.0014	6.41	15.9	2.9
150	0.016	90.431	1.718	-0.0289	0.0371	0.1641	0.0169	53.7	-0.053	0.0004	41.89	101.4	11.8
200	0.019	70.330	1.379	-0.0042	0.0273	0.0743	0.0119	31.2	-0.008	-0.0026	48.35	116.6	8.5
300	0.027	52.032	0.410	0.0075	0.0088	0.0262	0.0031	14.9	0.014	0.0010	44.26	107.0	2.3
450	0.049	50.224	0.398	-0.0023	0.0031	0.0195	0.0013	11.5	-0.004	0.0006	44.44	107.4	1.3
600	0.091	45.507	0.247	-0.0013	0.0020	0.0088	0.0008	5.7	-0.002	0.0005	42.89	103.8	0.8
750	0.176	43.320	0.174	-0.0022	0.0019	0.0022	0.0005	1.5	-0.004	0.0006	42.63	103.1	0.5
900	0.285	42.725	0.228	0.0000	0.0008	0.0009	0.0004	0.6	0.000	0.0006	42.42	102.7	0.6
1050	0.400	42.917	0.238	-0.0017	0.0007	0.0006	0.0003	0.4	-0.003	0.0004	42.71	103.3	0.6
1200	0.486	42.626	0.167	0.0002	0.0010	0.0012	0.0005	0.8	0.000	0.0006	42.25	102.3	0.5
2000	0.758	43.874	0.487	0.0007	0.0004	0.0014	0.0001	1.0	0.001	0.0005	43.42	105.0	1.2
8000	0.986	43.635	0.602	-0.0001	0.0005	0.0012	0.0002	0.8	0.000	0.0005	43.25	104.6	1.4
8700	1.000	45.057	0.389	-0.0028	0.0038	0.0046	0.0022	3.0	-0.005	-0.0003	43.67	105.6	1.8
Integrated		43.949	0.196	-0.0003	0.0003	0.0047	0.0001	3.1	0.000	0.0005	42.54	102.9	0.7

UA F084-52 125 WM 02-13-01 RICHARDSON Weighted average of J from standards = 0.001380 +/-0.000006

Laser Power	Fraction 39Ar	40Ar/39Ar measured	+/-	37Ar/39Ar measured	+/-	36Ar/39Ar measured	+/-	% Atm. 40Ar*	Ca/K	Cl/K	40*/39K	Age (Ma)	+/- (Ma)
150	0.002	82.592	10.071	-0.0025	0.2330	0.1381	0.1096	49.4	-0.005	-0.0060	41.77	101.1	76.3
200	0.002	37.192	8.150	-0.0883	0.1996	0.0743	0.1810	59.1	-0.162	-0.0281	15.19	37.4	130.2
300	0.006	51.133	3.018	0.0824	0.0679	0.0648	0.0549	37.5	0.151	0.0062	31.96	77.9	38.9
450	0.015	50.404	0.995	0.0155	0.0273	0.0319	0.0139	18.7	0.028	-0.0011	40.95	99.2	9.9
600	0.070	46.095	0.292	-0.0145	0.0047	0.0084	0.0019	5.4	-0.027	0.0014	43.57	105.4	1.5
750	0.260	44.017	0.174	-0.0062	0.0014	0.0051	0.0007	3.4	-0.011	0.0004	42.48	102.8	0.6
900	0.602	43.622	0.199	-0.0028	0.0012	0.0051	0.0005	3.4	-0.005	0.0004	42.10	101.9	0.6
1050	0.884	42.898	0.169	-0.0016	0.0009	0.0029	0.0003	2.0	-0.003	0.0005	42.01	101.7	0.4
1200	0.919	43.009	0.449	-0.0153	0.0083	-0.0034	0.0031	-2.4	-0.028	0.0005	43.99	106.4	2.4
2000	0.977	43.055	0.333	-0.0071	0.0078	-0.0001	0.0024	0.0	-0.013	0.0002	43.05	104.1	1.9
8000	1.000	43.965	0.574	0.0090	0.0244	0.0044	0.0067	2.9	0.016	0.0002	42.65	103.2	4.8
Integrated		43.724	0.097	-0.0038	0.0011	0.0047	0.0005	3.2	-0.007	0.0005	42.30	102.4	0.6

Table 15 continued. $^{40}Ar/^{39}Ar$ step-heating results and data.

UAF084-53 143 BI 02-14-01 RICHARDSON Weighted average of J from standards = 0.001380 +/- 0.000006

Laser Power	Fraction 39Ar	40Ar/39Ar measured	+/-	37Ar/39Ar measured	+/-	36Ar/39Ar measured	+/-	% Atm. 40Ar*	Ca/K	Cl/K	40*/39K	Age (Ma)	+/- (Ma)
0	0.000	-58.624	91.623	0.8905	3.5216	0.7584	1.8822	-382.0	1.635	0.3167	-282.86	-892.4	2525.1
150	0.190	36.220	0.650	0.0080	0.0024	0.0106	0.0007	8.6	0.015	0.0283	33.08	80.5	1.6
200	0.370	38.493	0.224	0.0008	0.0031	0.0015	0.0008	1.1	0.001	0.0242	38.03	92.3	0.8
300	0.519	38.055	0.215	0.0012	0.0028	0.0009	0.0008	0.7	0.002	0.0180	37.76	91.7	0.8
450	0.718	38.434	0.377	0.0017	0.0028	0.0008	0.0009	0.6	0.003	0.0201	38.17	92.6	1.1
600	0.869	38.003	0.308	0.0001	0.0030	0.0000	0.0011	0.0	0.000	0.0211	37.98	92.2	1.1
750	0.926	38.229	0.271	-0.0069	0.0088	-0.0004	0.0026	-0.3	-0.013	0.0193	38.32	93.0	1.9
900	0.950	37.771	0.385	-0.0123	0.0194	0.0017	0.0060	1.4	-0.022	0.0156	37.23	90.4	4.3
1050	0.962	37.966	0.542	-0.0394	0.0324	-0.0144	0.0110	-11.2	-0.072	0.0133	42.20	102.1	7.8
1200	0.972	37.980	0.731	-0.0295	0.0433	0.0196	0.0166	15.3	-0.054	0.0145	32.15	78.3	11.8
1500	0.980	38.910	0.738	-0.0096	0.0542	0.0071	0.0198	5.4	-0.018	0.0152	36.78	89.3	13.9
2000	0.991	38.251	0.559	0.0179	0.0244	0.0033	0.0096	2.5	0.033	0.0171	37.25	90.5	6.8
8800	1.000	41.606	1.222	-0.0027	0.0518	-0.0192	0.0117	-13.6	-0.005	0.0108	47.24	114.0	8.7
Integrated		37.909	0.164	0.0007	0.0016	0.0024	0.0005	1.9	0.001	0.0218	37.17	90.3	0.7

UAF083-56 GRI-1 Bl#1 02-04-01 RICHARDSON Weighted average of J from standards = 0.001380 +/- 0.000006

Laser Power	Fraction 39Ar	40Ar/39Ar measured	+/-	37Ar/39Ar measured	+/-	36Ar/39Ar measured	+/-	% Atm. 40Ar*	Ca/K	Cl/K	40*/39K	Age (Ma)	+/- (Ma)
150	0.006	37.907	0.636	0.1028	0.0144	0.0496	0.0044	38.7	0.189	0.0286	23.23	56.9	3.3
200	0.019	39.946	0.255	0.0241	0.0078	0.0113	0.0028	8.3	0.044	0.0367	36.59	88.9	2.0
300	0.076	37.656	0.171	0.0082	0.0010	0.0021	0.0005	1.6	0.015	0.0378	37.01	89.9	0.5
450	0.221	37.430	0.439	0.0066	0.0006	-0.0001	0.0002	-0.1	0.012	0.0384	37.42	90.9	1.1
600	0.364	37.589	0.504	0.0066	0.0011	-0.0006	0.0005	-0.5	0.012	0.0379	37.73	91.6	1.3
750	0.544	37.470	0.855	0.0127	0.0009	0.0006	0.0003	0.5	0.023	0.0376	37.26	90.5	2.0
900	0.802	37.497	0.730	0.0295	0.0006	0.0006	0.0003	0.4	0.054	0.0379	37.30	90.6	1.7
1050	0.935	37.144	0.211	0.1014	0.0015	-0.0005	0.0005	-0.4	0.186	0.0383	37.27	90.5	0.6
1200	0.980	37.649	0.221	0.3201	0.0044	-0.0011	0.0015	-0.9	0.587	0.0379	37.98	92.2	1.2
1500	0.990	37.298	0.297	0.9425	0.0143	-0.0004	0.0029	-0.5	1.730	0.0342	37.48	91.0	2.1
2000	0.996	37.261	0.359	0.5345	0.0238	0.0003	0.0053	0.1	0.981	0.0232	37.20	90.3	3.8
8800	1.000	51.353	0.565	0.2672	0.0186	0.0502	0.0060	28.8	0.490	0.0142	36.53	88.7	4.3
Integrated		37.554	0.264	0.0549	0.0005	0.0008	0.0002	0.6	0.101	0.0377	37.29	90.5	0.8

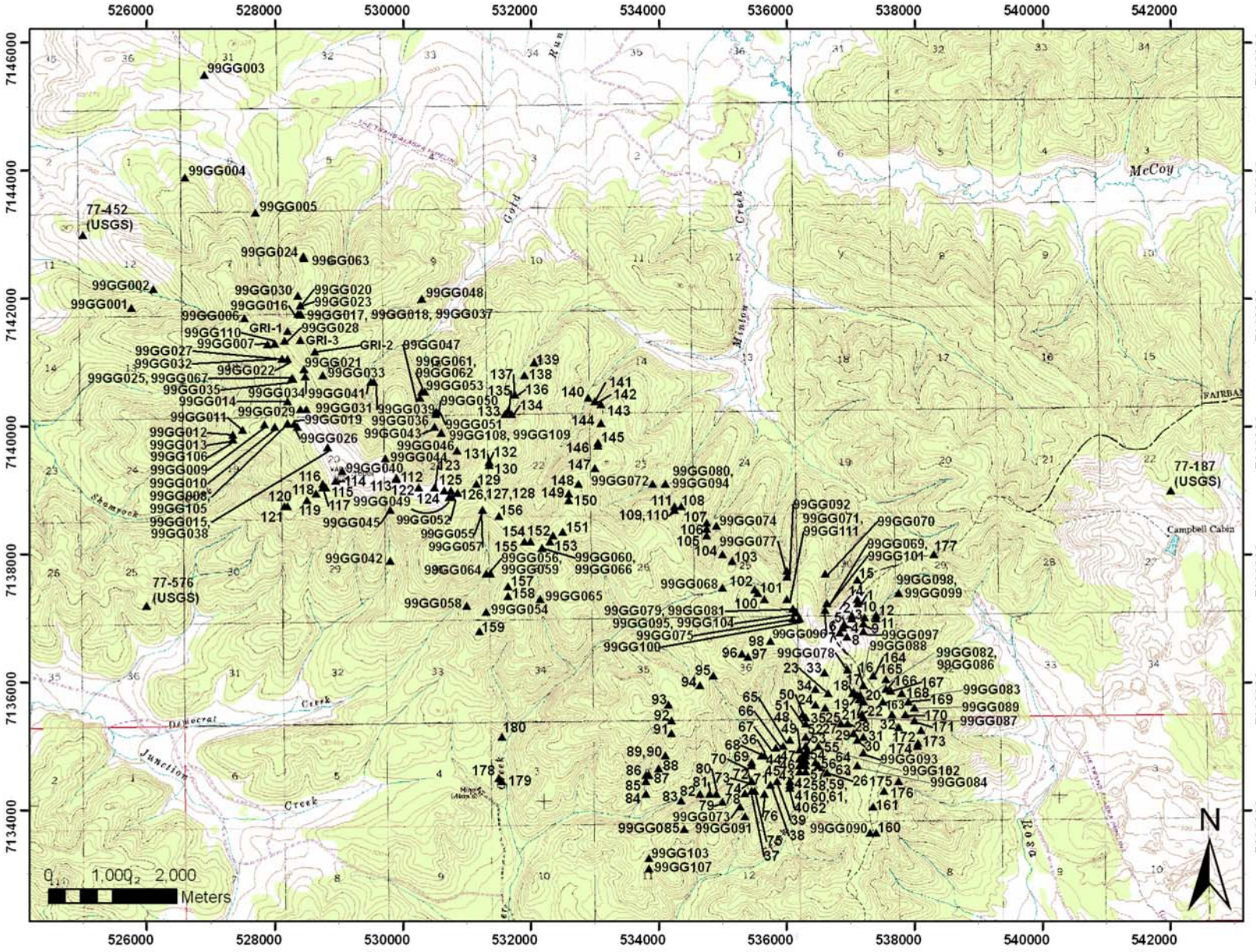

Figure 1. Location of analyzed samples from the Richardson district, Big Delta B-5 Quadrangle, Alaska.

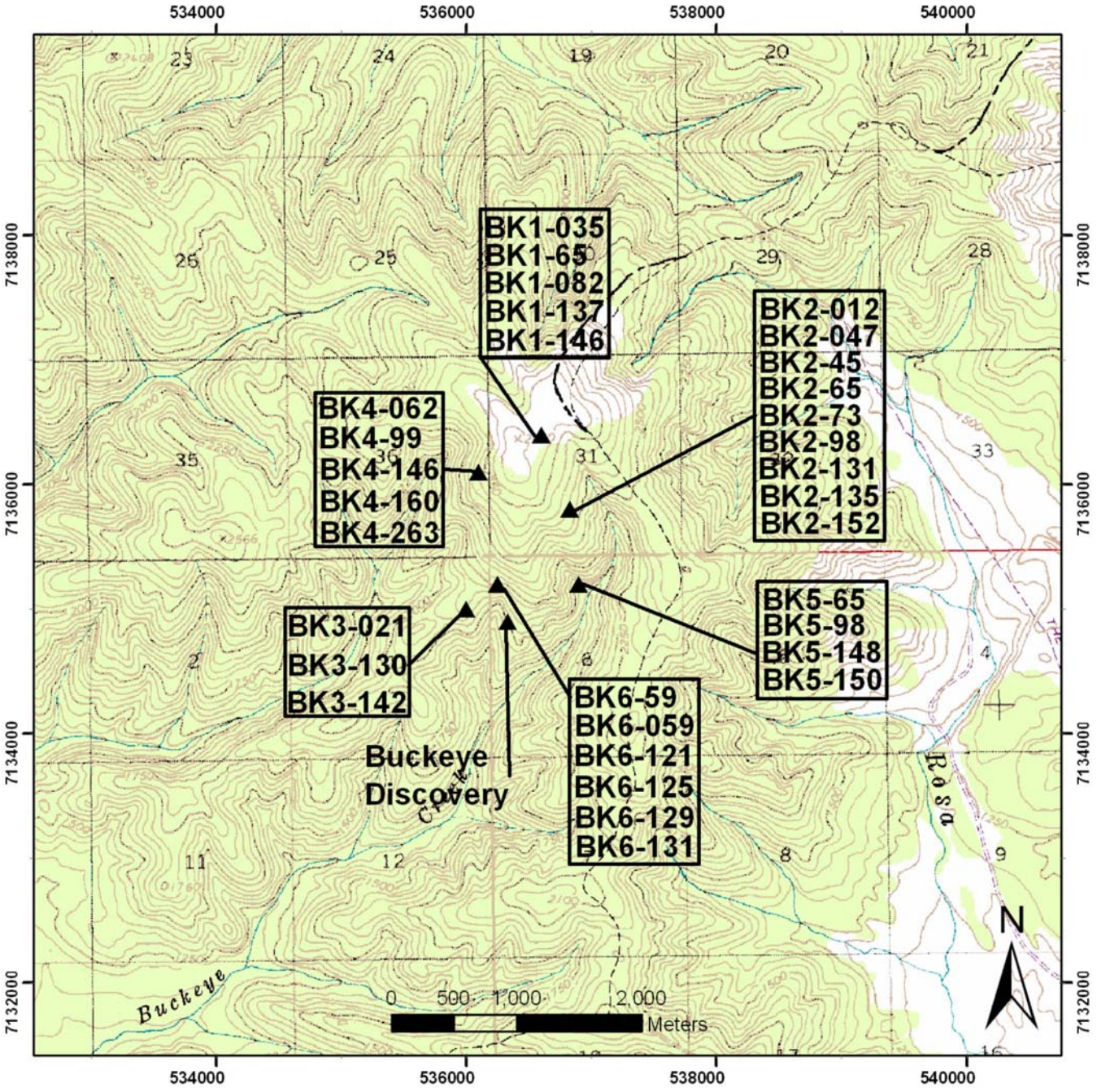

Figure 2. Location of Bald Knob drill hole samples from the Richardson district, Big Delta B-5 Quadrangle, Alaska. BK# = drill hole number.