



UNIVERSITY OF NEVADA RENO

Nevada Bureau of Mines and Geology
University of Nevada Reno
Reno, Nevada 89557-0088
(702) 784-6691

1986

NBMG OPEN FILE REPORT 86-15

BULK ROCK MAJOR AND TRACE ELEMENT GEOCHEMICAL DATA: WAH WAH SPRINGS TUFF, UTAH AND NEVADA

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This information has not been edited by NBMG.

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INTRODUCTION

The Wah Wah Springs Tuff Member of the Needles Range Formation was emplaced as a simple cooling unit about 30 mybp. The tuff is voluminous (3300 km^3), crystal-rich, calc-alkaline, and rhyodacitic to quartz latitic in bulk composition (Nusbaum and Grant, 1985). The outflow tuff contains broken to euhedral crystals of andesine, hornblende, biotite, quartz, clinopyroxene, titanomagnetite, ilmenite, apatite, zircon and pyrrhotite. Additional information regarding the petrology of the tuff is given in Nusbaum (1984).

A total of eight stratigraphic sections in Utah and Nevada have been sampled for chemical analysis (Figure 1). This report contains major element compositions and CIPW norms for 53 bulk rock samples (Table I) and trace element data for 41 samples (Table II). Details of sample locations are given in Appendix I.

ANALYTICAL PROCEDURES

X-RAY PROCEDURE

X-ray fluorescence analyses of uniformly finely ground and compressed rock powders furnished the chemical compositions for major element oxides presented in Table I. The chemical analyses employed ten inter-laboratory igneous standards (Flanagan, 1976; Leake et al., 1969) and a frequently monitored reference rock slab. The monitoring slab has essentially the same mineral abundances and content as that for Wah Wah Springs Tuff samples. Absorption and enhancement effects were corrected by standard procedures at the Geology and Geophysics Department, University of Missouri-Rolla, similar to those employed by Norrish and Hutton (1969). The overall precision of the methods used, in terms of coefficient of variation, ranges from 0.006 for silica to 0.090 for phosphate.

INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

Instrumental neutron activation analyses for twenty elements were performed at the Research Reactor Facility, University of Missouri-Columbia. Samples were irradiated for a total of ten hours at a flux of 10^4 neutrons $\text{cm}^{-2} \text{s}^{-1}$. Short-lived isotope intensity was evaluated after eight days and long-lived isotopic intensity measured after forty-two days following irradiation. The experiment was performed according to established procedures at the facility (Christopher et al., 1982). All counts were performed by using a large coaxial Ge(Li) detector (about 17% efficient, with a 1.79 KeV resolution). The detector system was coupled to an automatic sample changer and an 8192 channel Nuclear Data 6620 analyzer system. Precision for the analyses were determined by analyzing a monitoring standard repeatedly during the counting process.

Rocks containing relatively large amounts of uranium may present special problems as a result of interference produced from fission products and the activation of ^{238}U (Kennedy and Fowler, 1983; Erdtmann, 1972). A significant interference may result for rocks containing 25 ppm, however, maximum uranium fission interference is expected to be insignificant at these levels. Since the sample preparation included contact with a tungsten carbide milling container, values for Ta and Co may have been altered during the process.

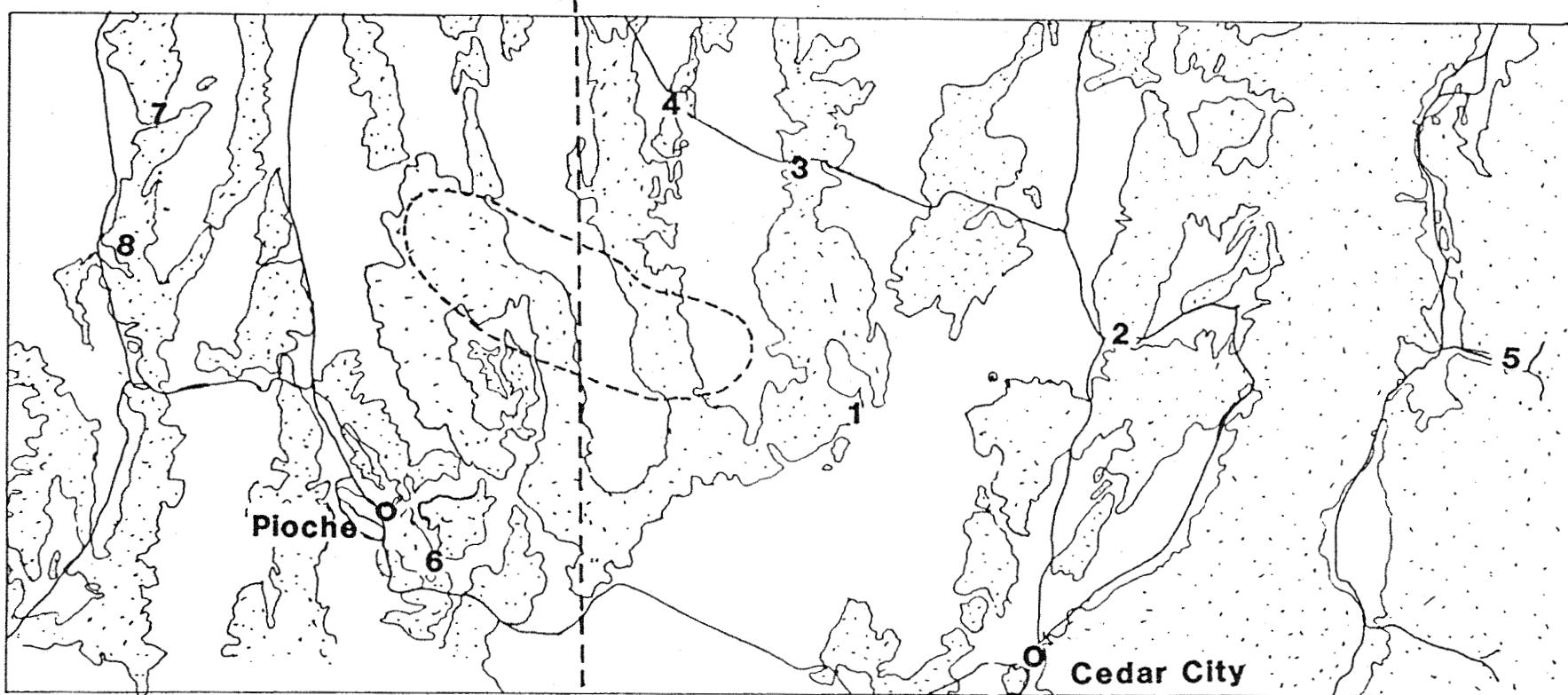


Fig. 1 Location of Sections

- 1 - Lund Section
- 2 - Minersville Section
- 3 - Wallaces Peak Section
- 4 - Needle Range Sections

- 5 - Kingston Section
- 6 - Condor Canyon Section
- 7 - Shingle Spring Sections
- 8 - South Egan Range Section

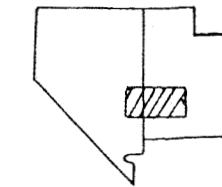


TABLE I
BULK ROCK ANALYSES[¢] FOR MAJOR ELEMENTS WITH CIPW NORMS

SAMPLE

NUMBER	82N1	82N2	82N3	82N4	82N5	82N6	82N7	82N8
SiO ₂	69.84	67.48	64.19	63.74	61.99	62.10	63.42	64.75
Al ₂ O ₃	13.61	14.36	13.94	15.52	15.85	15.55	15.83	16.23
Fe ₂ O ₃	4.37	4.85	4.86	5.24	5.49	5.25	5.35	5.55
MgO	1.68	1.39	3.20	3.24	2.02	2.79	3.13	2.48
CaO	2.63	4.17	6.01	4.86	7.47	6.62	4.95	3.62
Na ₂ O	2.04	2.71	3.07	2.87	2.72	3.00	2.73	2.73
K ₂ O	5.06	4.20	3.89	3.60	3.53	3.75	3.65	3.64
TiO ₂	0.55	0.61	0.62	0.68	0.72	0.70	0.70	0.71
P ₂ O ₅	0.15	0.15	0.15	0.18	0.15	0.16	0.17	0.21
MnO	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.06</u>	<u>0.06</u>	<u>0.08</u>	<u>0.07</u>	<u>0.09</u>
TOTAL	100.07	100.03	96.69	97.24	95.51	96.89	97.38	98.74
Q	29.54	24.36	16.16	17.73	15.63	13.77	17.74	22.28
OR	30.01	24.92	23.07	21.36	20.92	22.24	21.64	21.59
AB	17.32	23.02	26.01	24.34	23.07	25.45	23.19	23.13
AN	12.08	14.52	12.72	18.78	20.56	17.81	20.09	16.62
C	0.32	0	0	0	0	0	0	1.69
DI/WO	0	2.18	6.77	1.75	6.51	5.86	1.42	0
DI/EN	0	1.13	4.55	1.15	3.63	3.73	0.91	0
DI/FS	0	0.98	1.71	0.48	2.61	1.76	0.41	0
HY/EN	4.18	2.35	3.44	6.95	1.41	3.24	6.90	6.19
HY/FS	2.66	2.04	1.29	2.91	1.01	1.53	3.09	3.67
MT	2.21	2.41	2.43	2.50	2.56	2.58	2.53	2.63
IL	1.05	1.15	1.17	1.29	1.37	1.32	1.32	1.35
AP	0.36	0.37	0.35	0.43	0.36	0.38	0.41	0.49
OR:AB:AN [*]	0.51	0.40	0.37	0.33	0.32	0.34	0.33	0.35
	0.29	0.37	0.42	0.38	0.36	0.39	0.36	0.38
	0.20	0.23	0.21	0.29	0.32	0.27	0.31	0.27
OXD. [#]	0.343	0.338	0.339	0.324	0.317	0.333	0.322	0.321

^{*} Weight Fraction.[#] Atomic Fraction Fe⁺³/Fe total, based on empirical correlations withNa₂O and K₂O.[¢] Analyses are normalized to total of 100. Total given is raw total.

TABLE I CONTINUED

SAMPLE NUMBER	82N9	82N10	82N11	82N12	82N13	82N14	82N15
SiO ₂	64.51	63.10	63.53	62.65	64.36	63.86	63.76
Al ₂ O ₃	16.15	16.24	16.58	16.16	16.02	16.23	15.78
Fe ₂ O ₃	5.47	5.40	5.54	5.43	5.03	5.26	4.95
MgO	2.48	3.57	3.02	2.87	3.05	2.76	1.91
CaO	4.08	4.29	4.05	5.29	4.06	4.32	6.03
Na ₂ O	2.62	2.81	2.66	1.97	3.19	3.08	2.89
K ₂ O	3.67	3.61	3.61	3.65	3.50	3.54	3.78
TiO ₂	0.71	0.71	0.72	0.72	0.52	0.68	0.65
P ₂ O ₅	0.19	0.20	0.21	0.19	0.19	0.19	0.16
MnO	<u>0.10</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.08</u>	<u>0.08</u>	<u>0.09</u>
TOTAL	97.85	98.09	97.63	97.28	98.35	96.92	95.93
Q	21.50	17.22	19.81	15.69	18.01	17.94	17.76
OR	21.77	21.39	21.40	21.65	20.71	20.96	22.38
AB	22.26	23.85	22.59	25.21	27.06	26.10	24.51
AN	19.01	20.03	18.78	19.91	18.95	19.99	18.89
C	0.88	0.35	1.39	0	0.02	0	0
DI/WO	0	0	0	2.16	0	0.13	4.20
DI/EN	0	0	0	1.37	0	0.08	2.42
DI/FS	0	0	0	0.66	0	0.04	1.60
HY/EN	6.19	8.92	7.54	5.78	7.62	6.80	2.34
HY/FS	3.65	3.51	2.67	2.77	3.41	3.33	1.55
MT	2.58	2.56	2.59	2.62	2.45	2.55	2.42
IL	1.36	1.35	1.37	1.37	0.99	1.30	1.24
AP	0.46	0.47	0.50	0.44	0.46	0.44	0.38
OR:AB:AN	0.35	0.33	0.34	0.32	0.31	0.31	0.34
	0.35	0.37	0.36	0.38	0.41	0.39	0.37
	0.30	0.30	0.30	0.30	0.28	0.30	0.29
OXD.	0.319	0.323	0.318	0.329	0.331	0.328	0.330

TABLE I CONTINUED

SAMPLE NUMBER	82N16	82N17	82N18	82N19	82N20	82N30-A	82N30-B
SiO ₂	65.78	64.88	65.46	65.43	65.85	68.70	68.29
Al ₂ O ₃	14.99	14.99	15.23	15.22	15.14	14.24	14.24
Fe ₂ O ₃	5.08	5.16	5.09	5.01	4.94	4.30	4.35
MgO	2.20	2.50	2.27	2.37	2.33	1.49	1.68
CaO	4.45	5.30	4.53	4.61	4.53	3.39	3.53
Na ₂ O	2.85	2.81	2.94	2.96	2.81	2.79	2.90
K ₂ O	3.72	3.43	3.54	3.47	3.48	4.34	4.25
TiO ₂	0.66	0.67	0.67	0.66	0.65	0.52	0.54
P ₂ O ₅	0.19	0.18	0.19	0.19	0.19	0.16	0.16
MnO	<u>0.09</u>	<u>0.09</u>	<u>0.09</u>	<u>0.09</u>	<u>0.08</u>	<u>0.06</u>	<u>0.05</u>
TOTAL	98.36	97.04	98.63	98.22	99.55	98.99	98.22
Q	21.87	20.64	21.37	21.25	22.54	25.96	24.93
OR	22.03	20.30	20.96	20.54	20.59	25.73	25.19
AB	24.20	23.85	24.92	25.09	23.85	23.71	24.58
AN	17.05	18.12	17.87	17.97	18.37	13.43	13.24
C	0	0	0	0	0	0	0
DI/WO	1.60	2.95	1.43	1.55	1.22	1.00	1.34
DI/EN	0.95	1.79	0.85	0.94	0.74	0.56	0.79
DI/FS	0.57	1.00	0.50	0.52	0.42	0.40	0.49
HY/EN	4.54	4.44	4.81	4.96	5.07	3.16	3.41
HY/FS	2.71	2.64	2.81	2.76	2.85	2.24	2.14
MT	2.46	2.42	2.44	2.39	2.32	2.18	2.20
IL	1.25	1.27	1.27	1.25	1.24	0.99	1.03
AP	0.45	0.43	0.45	0.45	0.45	0.38	0.39
OR:AB:AN	0.35	0.33	0.33	0.32	0.33	0.41	0.40
	0.38	0.38	0.39	0.40	0.38	0.38	0.39
	0.27	0.29	0.28	0.28	0.29	0.21	0.21
OXD.	0.327	0.317	0.324	0.323	0.319	0.344	0.344

TABLE I CONTINUED

SAMPLE NUMBER	82N30-C	82N30	82N31	82N32	82N33	82N34	82N34-B
SiO ₂	68.67	70.50	65.03	62.60	69.79	66.96	66.92
Al ₂ O ₃	14.29	13.90	15.58	14.55	13.98	15.03	14.89
Fe ₂ O ₃	4.24	3.59	5.22	5.00	3.75	4.34	4.46
MgO	1.54	1.64	1.61	0.86	1.69	1.70	1.76
CaO	3.45	3.05	4.48	7.72	3.17	3.95	4.04
Na ₂ O	2.71	3.10	2.82	2.05	3.05	2.87	2.75
K ₂ O	4.34	3.54	4.28	6.31	3.88	4.34	4.36
TiO ₂	0.54	0.44	0.69	0.72	0.46	0.60	0.60
P ₂ O ₅	0.17	0.15	0.18	0.12	0.15	0.18	0.17
MnO	<u>0.06</u>	<u>0.07</u>	<u>0.10</u>	<u>0.07</u>	<u>0.07</u>	<u>0.04</u>	<u>0.06</u>
TOTAL	98.69	96.95	99.17	97.62	97.25	99.09	98.42
Q	26.23	29.26	20.04	13.32	27.49	22.56	22.88
OR	25.70	21.00	25.35	37.42	23.00	25.69	25.85
AB	22.98	26.34	23.90	17.39	25.87	24.38	23.30
AN	13.97	13.47	17.18	11.79	12.93	15.24	15.37
C	0	0	0	0	0	0	0
DI/WO	0.86	0.30	1.62	4.60	0.77	1.36	1.51
DI/EN	0.49	0.18	0.88	2.14	0.47	0.81	0.89
DI/FS	0.33	0.10	0.69	2.41	0.26	0.48	0.54
WO	0	0	0	6.17	0	0	0
HY/EN	3.34	3.92	3.15	0	3.76	3.43	3.49
HY/FS	2.26	2.25	2.46	0	2.11	2.03	2.10
MT	2.13	1.76	2.65	2.81	1.88	2.20	2.25
IL	1.02	0.84	1.32	1.37	0.87	1.13	1.14
AP	0.41	0.36	0.44	0.28	0.36	0.42	0.41
OR:AB:AN	0.41	0.35	0.38	0.56	0.37	0.39	0.40
	0.37	0.43	0.36	0.26	0.42	0.37	0.36
	0.22	0.22	0.26	0.17	0.21	0.24	0.24
OXD.	0.341	0.329	0.343	0.381	0.338	0.346	0.343

TABLE I CONTINUED

SAMPLE NUMBER	82N35	82N36	82N37	82N38	82N39	76-9-11	76-9-12
SiO ₂	62.18	61.60	64.53	63.85	64.24	65.35	66.02
Al ₂ O ₃	17.13	16.69	16.31	16.16	15.57	14.98	15.28
Fe ₂ O ₃	5.01	5.46	5.37	5.52	5.07	4.75	4.55
MgO	0.92	0.92	2.88	2.39	2.63	3.09	1.97
CaO	1.67	2.49	3.79	4.73	5.53	3.69	4.08
Na ₂ O	1.42	1.43	2.55	2.65	2.68	2.91	3.31
K ₂ O	10.58	10.33	3.64	3.77	3.33	4.43	0.59
TiO ₂	0.81	0.82	0.68	0.69	0.66	0.58	0.59
P ₂ O ₅	0.23	0.22	0.19	0.18	0.18	0.15	0.17
MnO	<u>0.05</u>	<u>0.04</u>	<u>0.06</u>	<u>0.08</u>	<u>0.09</u>	<u>0.08</u>	<u>0.07</u>
TOTAL	97.82	97.09	97.19	97.36	98.54	98.20	98.67
Q	8.51	7.48	22.12	19.31	20.11	18.55	19.89
OR	62.70	61.19	21.57	22.32	19.74	26.23	23.49
AB	12.08	12.15	21.64	22.45	22.76	24.65	28.10
AN	6.81	8.54	17.55	21.04	20.57	14.71	15.07
C	0.81	0	1.73	0	0	0	0
DI/WO	0	0.98	0	0.56	2.41	1.09	1.71
DI/EN	0	0.61	0	0.33	1.48	0.73	1.04
DI/FS	0	0.31	0	0.20	0.79	0.27	0.57
HY/EN	2.29	1.68	7.19	5.64	5.09	6.98	3.87
HY/FS	0.89	0.85	3.62	3.45	2.70	2.58	2.12
MT	3.60	3.85	2.49	2.62	2.33	2.45	2.34
IL	1.53	1.56	1.28	1.31	1.25	1.10	1.12
AP	0.55	0.54	0.46	0.42	0.43	0.37	0.40
OR:AB:AN	0.77	0.75	0.35	0.34	0.31	0.40	0.35
	0.15	0.15	0.36	0.34	0.36	0.38	0.42
	0.08	0.10	0.29	0.32	0.33	0.22	0.23
OXD.	0.490	0.483	0.316	0.322	0.310	0.350	0.348

TABLE I CONTINUED

SAMPLE NUMBER	76-9-13	82N41	82N42	82N43	82N44-A	82N44-B	82N45
SiO ₂	65.76	64.66	63.95	64.82	66.51	66.30	66.68
Al ₂ O ₃	15.39	15.92	15.44	15.47	15.15	14.84	14.71
Fe ₂ O ₃	4.55	5.38	5.42	5.31	5.29	5.33	5.42
MgO	1.68	3.19	2.85	2.90	1.71	1.92	1.72
CaO	4.44	4.94	5.21	4.62	4.00	4.30	4.25
Na ₂ O	3.09	2.13	2.93	2.44	2.49	2.53	2.26
K ₂ O	4.27	2.86	3.23	3.48	3.93	3.86	4.04
TiO ₂	0.57	0.64	0.69	0.70	0.66	0.67	0.68
P ₂ O ₅	0.16	0.19	0.20	0.19	0.17	0.18	0.17
MnO	<u>0.09</u>	<u>0.09</u>	<u>0.09</u>	<u>0.08</u>	<u>0.09</u>	<u>0.08</u>	<u>0.09</u>
TOTAL	98.44	97.06	97.95	97.43	98.86	99.46	99.12
Q	19.66	24.47	19.00	21.99	24.67	24.04	25.53
OR	25.33	16.94	19.16	20.62	23.29	22.90	23.92
AB	26.23	18.10	24.82	20.71	21.13	21.43	19.17
AN	15.42	23.30	19.38	20.93	18.51	17.70	18.02
C	0	0.77	0	0	0	0	0
DI/WO	2.35	0	2.19	0.34	0.10	1.05	0.83
DI/EN	1.36	0	1.36	0.21	0.05	0.58	0.43
DI/FS	0.88	0	0.70	0.11	0.04	0.43	0.37
HY/EN	2.83	7.96	5.75	7.02	4.20	4.20	3.86
HY/FS	1.82	4.20	2.97	3.55	3.47	3.10	3.28
MT	2.37	2.22	2.52	2.40	2.52	2.52	2.55
IL	1.09	1.22	1.31	1.32	1.25	1.27	1.28
AP	0.38	0.46	0.47	0.46	0.41	0.42	0.41
OR:AB:AN	0.38	0.29	0.30	0.33	0.37	0.37	0.39
	0.39	0.31	0.39	0.33	0.34	0.35	0.31
	0.23	0.40	0.31	0.34	0.29	0.28	0.29
OXD.	0.351	0.280	0.315	0.308	0.323	0.322	0.319

TABLE I CONTINUED

SAMPLE NUMBER	82-1	82-2	82-4	82-5
SiO ₂	64.08	64.65	64.83	64.93
Al ₂ O ₃	15.59	15.33	15.23	15.72
Fe ₂ O ₃	5.43	5.23	5.20	5.43
MgO	2.88	2.72	2.78	2.45
CaO	4.48	4.87	4.85	4.63
Na ₂ O	2.92	2.75	2.85	2.50
K ₂ O	3.27	3.48	3.33	3.40
TiO ₂	0.72	0.69	0.66	0.67
P ₂ O ₅	0.20	0.19	0.17	0.19
MnO	<u>0.08</u>	<u>0.09</u>	<u>0.08</u>	<u>0.07</u>
TOTAL	98.59	98.17	98.29	96.72
Q	19.36	20.45	20.56	22.51
OR	19.38	20.63	19.72	20.14
AB	24.74	23.33	24.22	21.19
AN	19.74	19.15	18.89	21.60
C	0	0	0	0
DI/WO	1.24	1.61	1.71	0.08
DI/EN	0.78	1.00	1.07	0.04
DI/FS	0.39	0.52	0.54	0.03
HY/EN	6.41	5.78	5.88	6.08
HY/FS	3.23	2.99	2.99	3.79
MT	2.53	2.45	2.42	2.45
IL	1.37	1.30	1.25	1.28
AP	0.48	0.44	0.42	0.46
OR:AB:AN	0.30	0.33	0.31	0.32
	0.39	0.37	0.39	0.34
	0.31	0.30	0.30	0.34
OXD.	0.316	0.317	0.315	0.307

TABLE I CONTINUED

SAMPLE NUMBER	82N46	82N47	82N48	82N49	82N50	82N51
SiO ₂	70.20	66.09	65.46	65.26	65.07	64.45
Al ₂ O ₃	12.98	14.36	14.71	14.92	15.22	15.65
Fe ₂ O ₃	4.41	5.28	5.57	5.35	5.50	5.51
MgO	1.70	2.30	2.70	2.58	2.65	2.65
CaO	3.74	4.80	4.74	4.69	4.79	4.85
Na ₂ O	2.39	2.44	2.32	2.82	2.43	2.93
K ₂ O	3.81	3.83	3.55	3.43	3.36	3.03
TiO ₂	0.55	0.64	0.68	0.68	0.70	0.66
P ₂ O ₅	0.16	0.17	0.18	0.18	0.20	0.18
MnO	<u>0.07</u>	<u>0.08</u>	<u>0.09</u>	<u>0.09</u>	<u>0.08</u>	<u>0.09</u>
TOTAL	99.77	98.57	98.51	98.41	98.45	97.17
Q	31.06	23.47	23.45	21.47	22.90	20.56
OR	22.55	22.70	21.04	20.31	19.94	17.97
AB	20.24	20.74	19.66	23.92	20.60	24.84
AN	13.43	16.86	19.21	17.89	20.66	20.55
C	0	0	0	0	0	0
DI/WO	1.70	2.46	1.33	1.77	0.78	1.01
DI/EN	0.96	1.44	0.80	1.07	0.47	0.60
DI/FS	0.68	0.90	0.47	0.60	0.28	0.35
HY/EN	3.28	4.30	5.95	5.37	6.14	6.02
HY/FS	2.34	2.69	3.47	3.01	3.61	3.55
MT	2.06	2.48	2.51	2.51	2.46	2.51
IL	1.04	1.22	1.30	1.29	1.33	1.25
AP	0.39	0.40	0.43	0.44	0.47	0.43
OR:AB:AN	0.40	0.38	0.35	0.33	0.33	0.29
	0.36	0.34	0.33	0.38	0.34	0.39
	0.24	0.28	0.32	0.29	0.34	0.32
OXD.	0.316	0.318	0.306	0.317	0.304	0.309

TABLE II
BULK ROCK: INSTRUMENTAL NEUTRON ACTIVATION ANALYSES*

	82N1	82N2	82N4	82N5	82N7
Ba	900±60	930±60	900±60	2100±90	830±50
Sr	300±30	490±40	510±40	470±30	530±30
Rb	140±4	111±4	119±4	107±5	120±4
Cs	3.3±0.2	2.4±0.1	2.1±0.1	1.9±0.1	1.7±0.1
Th	15.6±0.2	16.0±0.2	18.9±0.3	17.9±0.3	19.2±0.3
U	3.0±0.3	2.8±0.3	4.1±0.3	3.5±0.3	3.9±0.3
Sc	12.1±0.2	13.0±0.2	14.4±0.2	13.0±0.2	14.0±0.2
Cr	45±6	52±7	47±7	48±7	50±7
Co	14.3±0.9	15.5±0.9	17.3±1.0	15.2±0.9	16.0±1.0
Hf	4.8±0.2	4.6±0.2	6.7±0.3	4.9±0.3	4.7±0.2
Ta	0.78±0.08	0.82±0.09	0.92±0.10	1.02±0.11	0.87±0.09
La	43.8±1.9	43.0±1.9	48.8±2.1	63.1±2.7	49.3±2.1
Ce	64±5	67±5	74±5	267±19	75±5
Sm	4.9±0.3	4.9±0.3	5.6±0.4	5.8±0.4	5.7±0.4
Eu	0.96±0.04	1.02±0.05	1.09±0.05	1.11±0.05	1.10±0.05
Tb	0.66±0.04	0.68±0.04	0.70±0.04	0.67±0.04	0.74±0.04
Yb	1.4±0.2	1.5±0.2	1.5±0.2	1.3±0.2	1.5±0.2
Lu	0.28±0.02	0.33±0.02	0.39±0.02	0.36±0.02	0.34±0.02
Na ₂ O	2.37±0.03	2.76±0.01	2.92±0.02	3.53±0.02	2.64±0.01
FeO	4.59±0.03	4.97±0.04	5.26±0.04	4.74±0.03	5.17±0.04

* All values in parts per million except for Na₂O and FeO which have been converted to weight percent oxide. FeO represents total iron.

TABLE II Continued

	82N8	82N9	82N10	82N11	82N12
Ba	840±60	830±60	840±50	1100±60	820±60
Sr	500±40	470±40	520±30	510±40	560±40
Rb	133±4	122±4	132±4	129±4	123±4
Cs	1.8±0.1	1.8±0.1	1.9±0.1	1.7±0.1	1.7±0.1
Th	19.8±0.3	19.7±0.3	19.9±0.3	19.3±0.3	19.2±0.3
U	3.1±0.3	3.5±0.3	4.1±0.3	4.5±0.3	3.7±0.3
Sc	14.8±0.2	14.4±0.2	15.4±0.2	15.4±0.2	15.5±0.2
Cr	50±7	48±7	51±7	49±7	51±7
Co	16.4±1.0	17.3±1.0	18.0±1.1	16.7±1.0	18.0±1.1
Hf	6.5±0.3	5.2±0.3	4.2±0.2	5.0±0.3	5.5±0.3
Ta	0.91±0.10	0.98±0.10	0.95±0.10	0.93±0.10	0.93±0.10
La	50.1±2.1	50.5±2.1	51.7±2.2	53.8±2.3	50.0±2.1
Ce	79±6	78±6	81±6	114±8	79±6
Sm	5.6±0.4	5.7±0.4	6.3±0.4	6.3±0.4	5.8±0.4
Eu	1.15±0.05	1.18±0.05	1.22±0.06	1.21±0.06	1.21±0.06
Tb	0.75±0.05	0.78±0.05	0.80±0.05	0.72±0.04	0.82±0.05
Yb	1.6±0.2	1.9±0.2	1.6±0.2	1.7±0.2	1.8±0.3
Lu	0.31±0.02	0.43±0.03	0.36±0.02	0.40±0.02	0.38±0.02
Na ₂ O	2.68±0.01	2.55±0.01	2.69±0.02	2.83±0.02	2.73±0.01
FeO	5.44±0.04	5.22±0.04	5.39±0.04	5.42±0.04	5.66±0.04

TABLE II Continued

	82N16	82N17	82N18	82N19	82N20
Ba	900 \pm 50	850 \pm 50	860 \pm 60	840 \pm 70	800 \pm 60
Sr	540 \pm 40	560 \pm 40	540 \pm 40	610 \pm 40	760 \pm 60
Rb	135 \pm 5	122 \pm 4	133 \pm 4	130 \pm 5	127 \pm 4
Cs	3.1 \pm 0.2	3.2 \pm 0.1	3.0 \pm 0.2	3.1 \pm 0.2	3.1 \pm 0.2
Th	22.2 \pm 0.3	20.8 \pm 0.3	22.4 \pm 0.3	22.4 \pm 0.3	21.8 \pm 0.3
U	3.9 \pm 0.3	4.4 \pm 0.3	4.8 \pm 0.3	3.8 \pm 0.4	3.9 \pm 0.3
Sc	14.3 \pm 0.2	14.5 \pm 0.2	14.6 \pm 0.2	14.3 \pm 0.2	14.4 \pm 0.2
Cr	47 \pm 6	46 \pm 6	49 \pm 7	58 \pm 8	48 \pm 7
Co	17.5 \pm 1.1	17.4 \pm 1.0	17.6 \pm 1.1	16.8 \pm 1.0	17.5 \pm 1.1
Hf	5.1 \pm 0.3	5.3 \pm 0.3	5.5 \pm 0.3	5.0 \pm 0.3	4.9 \pm 0.3
Ta	1.06 \pm 0.11	0.97 \pm 0.10	1.08 \pm 0.11	1.03 \pm 0.11	1.03 \pm 0.11
La	54.1 \pm 2.3	49.5 \pm 2.1	52.8 \pm 2.2	50.6 \pm 2.2	49.8 \pm 2.1
Ce	82 \pm 6	79 \pm 6	82 \pm 6	80 \pm 6	82 \pm 6
Sm	6.1 \pm 0.4	5.7 \pm 0.4	6.0 \pm 0.4	5.8 \pm 0.4	5.7 \pm 0.4
Eu	1.13 \pm 0.05	1.14 \pm 0.05	1.15 \pm 0.05	1.13 \pm 0.05	1.10 \pm 0.05
Tb	0.74 \pm 0.04	0.70 \pm 0.04	0.70 \pm 0.04	0.67 \pm 0.04	0.79 \pm 0.05
Yb	1.6 \pm 0.2	1.7 \pm 0.3	1.6 \pm 0.2	1.4 \pm 0.2	1.7 \pm 0.3
Lu	0.36 \pm 0.02	0.36 \pm 0.02	0.39 \pm 0.02	0.34 \pm 0.02	0.34 \pm 0.02
Na ₂ O	2.84 \pm 0.02	2.88 \pm 0.02	3.03 \pm 0.02	2.92 \pm 0.02	2.76 \pm 0.01
FeO	5.26 \pm 0.04	5.26 \pm 0.04	5.30 \pm 0.04	5.23 \pm 0.04	5.32 \pm 0.04

TABLE II Continued

	82N30	82N30-B	82N31	82N33	82N34
Ba	1000±60	880±60	860±60	880±50	800±60
Sr	320±40	440±30	530±40	410±40	480±40
Rb	178±4	164±4	181±5	180±5	176±4
Cs	8.8±0.4	10.1±0.4	17.9±0.8	10.9±0.5	15.3±0.6
Th	29.0±0.4	27.5±0.4	21.0±0.3	30.0±0.4	25.2±0.4
U	7.4±0.4	4.7±0.3	4.3±0.3	7.4±0.4	3.8±0.3
Sc	8.1±0.1	10.1±0.2	14.8±0.2	8.8±0.1	11.8±0.2
Cr	34±5	43±6	55±8	35±5	46±6
Co	10.4±0.6	12.7±0.8	15.3±0.9	11.3±0.7	15.4±0.9
Hf	5.3±0.3	5.4±0.3	5.1±0.3	5.2±0.3	5.5±0.3
Ta	1.23±0.13	1.22±0.13	1.02±0.11	1.27±0.13	1.04±0.11
La	53.3±4.6	53.2±2.2	50.7±2.2	53.2±2.2	51.2±2.2
Ce	80±6	80±6	81±6	84±6	81±6
Sm	4.6±0.3	4.9±0.3	5.4±0.4	4.7±0.3	5.0±0.3
Eu	0.79±0.04	0.87±0.04	1.11±0.05	0.85±0.04	0.99±0.05
Tb	0.53±0.03	0.76±0.05	0.58±0.04	0.54±0.03	0.60±0.04
Yb	1.5±0.2	1.3±0.3	1.2±0.2	1.6±0.2	1.2±0.2
Lu	0.27±0.02	0.32±0.02	0.27±0.02	0.26±0.02	0.26±0.02
Na ₂ O	3.14±0.02	2.69±0.01	2.84±0.02	2.96±0.02	2.69±0.01
FeO	3.37±0.03	4.17±0.03	5.26±0.04	3.74±0.03	4.59±0.03

TABLE II Continued

	82N34-B	82N35	82N36	82N37	82N38
Ba	860±50	780±50	880±60	840±60	880±50
Sr	510±30	130±30	230±30	470±30	590±50
Rb	186±4	445±8	455±8	121±4	108±4
Cs	14.5±0.6	20.4±0.9	20.9±0.9	3.3±0.2	3.1±0.2
Th	25.0±0.4	23.4±0.4	23.4±0.4	18.8±0.3	18.8±0.3
U	5.5±0.3	4.2±0.4	3.9±0.3	3.3±0.3	4.9±0.4
Sc	12.3±0.2	14.0±0.2	15.2±0.2	14.6±0.2	15.3±0.2
Cr	46±6	46±6	49±7	48±7	48±7
Co	14.6±0.9	17.4±1.0	18.2±1.1	17.4±1.0	17.3±1.0
Hf	6.2±0.3	5.6±0.3	5.1±0.3	4.8±0.3	51.±0.3
Ta	1.09±0.12	0.99±0.11	1.09±0.12	0.93±0.10	0.90±0.10
La	53.8±2.3	55.5±2.4	53.9±2.3	47.4±2.0	49.2±2.1
Ce	84±6	84±6	87±6	76±5	79±6
Sm	5.3±0.4	6.0±0.4	6.0±0.4	5.8±0.4	6.3±0.4
Eu	1.03±0.05	1.12±0.05	1.17±0.05	1.15±0.05	1.24±0.06
Tb	0.74±0.05	0.70±0.04	0.67±0.04	0.54±0.03	0.76±0.05
Yb	1.3±0.3	1.5±0.2	1.6±0.2	1.6±0.2	1.5±0.2
Lu	0.33±0.02	0.31±0.02	0.36±0.02	0.34±0.02	0.35±0.02
Na ₂ O	2.77±0.01	1.44±0.01	1.48±0.01	2.42±0.01	2.84±0.02
FeO	4.70±0.03	5.04±0.04	5.53±0.04	5.33±0.04	5.52±0.04

TABLE II Continued

	82N39	76-9-11	76-9-12	76-9-13	82N41
Ba	870±60	1000±60	910±60	930±60	640±60
Sr	620±40	390±40	790±60	410±30	540±40
Rb	121±4	138±5	149±4	141±4	125±4
Cs	3.7±0.2	9.2±0.4	8.4±0.4	4.6±0.2	9.6±0.4
Th	18.5±0.3	20.0±0.2	22.9±0.3	23.1±0.3	20.4±0.3
U	4.7±0.3	6.7±0.4	5.3±0.4	3.9±0.3	4.2±0.3
Sc	14.4±0.2	12.5±0.2	11.9±0.2	12.4±0.2	15.4±0.2
Cr	49±7	42±6	45±6	44±6	51±7
Co	17.1±1.0	15.8±1.0	14.7±0.9	15.3±0.9	18.8±1.1
Hf	5.1±0.3	4.3±0.2	5.4±0.3	5.0±0.3	5.0±0.3
Ta	0.93±0.10	0.86±0.09	1.00±0.11	1.00±0.11	0.96±0.10
La	48.5±2.1	47.2±2.0	50.5±2.1	48.5±2.1	56.9±2.4
Ce	76±5	72±5	83±6	78±6	86±6
Sm	5.7±0.4	5.4±0.4	5.3±0.4	5.2±0.3	6.5±0.4
Eu	1.14±0.05	0.95±0.04	1.02±0.05	1.02±0.05	1.25±0.06
Tb	0.71±0.04	0.61±0.04	0.67±0.04	0.65±0.04	0.83±0.05
Yb	1.7±0.3	1.5±0.2	1.3±0.2	1.4±0.2	1.8±0.3
Lu	0.36±0.02	0.32±0.02	0.37±0.02	0.27±0.02	0.42±0.03
Na ₂ O	2.69±0.02	2.91±0.02	3.02±0.02	2.90±0.01	2.68±0.01
FeO	5.20±0.04	4.59±0.04	4.54±0.03	4.74±0.03	5.62±0.04

TABLE II Continued

	82N42	82N43	82N44-A	82N44-B	82N45
Ba	940±60	920±60	940±60	980±70	840±60
Sr	620±40	530±40	610±40	530±40	630±40
Rb	121±4	120±4	132±5	120±4	121±5
Cs	3.8±0.2	2.2±0.1	2.0±0.1	2.0±0.1	5.2±0.2
Th	19.3±0.3	21.2±0.3	20.6±0.3	19.4±0.3	19.3±0.3
U	4.4±0.3	4.1±0.3	2.7±0.3	2.8±0.3	2.4±0.3
Sc	15.8±0.2	15.2±0.2	15.5±0.2	15.5±0.2	15.6±0.2
Cr	50±7	47±6	48±7	47±7	48±7
Co	18.8±1.1	17.9±1.1	18.6±1.1	18.4±1.1	19.4±1.2
Hf	4.7±0.2	5.4±0.3	4.9±0.3	5.0±0.3	5.3±0.3
Ta	0.99±0.10	1.00±0.11	1.02±0.11	0.96±0.10	0.92±0.10
La	49.6±2.1	53.2±2.2	53.0±2.3	51.5±2.2	49.9±2.1
Ce	80±6	83±6	81±6	78±6	79±6
Sm	6.0±0.4	6.1±0.4	5.9±0.4	6.0±0.4	5.9±0.4
Eu	1.19±0.06	1.19±0.06	1.24±0.06	1.15±0.05	1.18±0.06
Tb	0.76±0.05	0.82±0.05	0.72±0.05	0.74±0.05	0.75±0.05
Yb	1.8±0.3	1.7±0.3	1.6±0.3	1.8±0.3	1.7±0.3
Lu	0.33±0.02	0.42±0.02	0.38±0.02	0.36±0.03	0.38±0.02
Na ₂ O	2.90±0.01	2.75±0.01	2.73±0.02	2.73±0.01	2.65±0.01
FeO	5.66±0.04	5.39±0.04	5.60±0.04	5.43±0.04	5.63±0.04

TABLE II Continued

	82-1	82-2	82-4	82N46	82N47
Ba	890±50	870±60	820±50	860±60	800±60
Sr	510±40	570±40	570±50	590±40	690±40
Rb	119±4	117±4	127±4	117±4	125±4
Cs	3.0±0.1	2.8±0.1	4.2±0.2	2.4±0.1	3.7±0.2
Th	19.3±0.3	20.7±0.3	19.7±0.3	19.2±0.3	19.7±0.3
U	3.7±0.3	3.6±0.3	4.3±0.3	3.2±0.3	2.7±0.3
Sc	15.7±0.2	15.6±0.2	14.7±0.2	12.2±0.2	14.9±0.2
Cr	51±7	53±7	46±6	38±5	48±7
Co	18.7±1.1	18.8±1.1	17.3±1.0	14.2±0.9	17.9±1.1
Hf	5.0±0.3	6.0±0.3	5.3±0.3	4.9±0.3	4.9±0.3
Ta	1.00±0.10	0.98±0.11	0.95±0.10	0.90±0.10	0.98±0.10
La	53.2±2.3	51.2±2.2	49.8±2.1	46.8±2.0	49.2±2.1
Ce	81±6	86±6	78±6	71±5	78±6
Sm	6.4±0.4	5.7±0.4	6.0±0.4	4.8±0.3	5.6±0.4
Eu	1.24±0.06	1.20±0.06	1.14±0.05	1.01±0.05	1.15±0.05
Tb	0.73±0.04	0.79±0.05	0.74±0.04	0.82±0.05	0.75±0.05
Yb	1.8±0.3	1.8±0.3	1.7±0.3	1.3±0.3	1.7±0.3
Lu	0.38±0.02	0.35±0.02	0.39±0.02	0.31±0.02	0.38±0.02
Na ₂ O	2.91±0.02	2.80±0.01	2.84±0.02	2.47±0.01	2.69±0.01
FeO	5.73±0.04	5.62±0.04	5.20±0.04	4.43±0.03	5.42±0.04

TABLE II Continued

	82N48	82N49	82N50	82N51
Ba	840± 60	920± 60	740± 50	2100± 90
Sr	660± 40	620± 40	680± 40	560± 40
Rb	112± 4	122± 4	121± 5	113± 4
Cs	2.0± 0.1	2.8± 0.1	3.1± 0.2	5.0± 0.2
Th	18.4± 0.3	20.4± 0.3	20.4± 0.3	19.2± 0.3
U	2.6± 0.3	4.0± 0.3	4.5± 0.3	4.9± 0.3
Sc	15.9± 0.2	15.4± 0.2	15.5± 0.2	13.6± 0.2
Cr	50± 7	49± 7	48± 7	51± 7
Co	19.1± 1.2	18.4± 1.1	18.2± 1.1	16.1± 1.0
Hf	4.8± 0.3	5.9± 0.3	4.9± 0.3	5.5± 0.3
Ta	0.88± 0.09	0.99± 0.11	1.00± 0.11	0.90± 0.10
La	49.4± 2.1	50.3± 2.1	50.5± 2.1	67.0± 2.8
Ce	78± 6	84± 6	80± 6	296± 21
Sm	5.9± 0.4	6.0± 0.4	5.9± 0.4	6.1± 0.4
Eu	1.22± 0.06	1.19± 0.06	1.20± 0.05	1.17± 0.05
Tb	0.77± 0.05	0.76± 0.05	0.75± 0.05	0.69± 0.04
Yb	1.9± 0.2	1.6± 0.2	1.5± 0.2	1.8± 0.2
Lu	0.37± 0.02	0.37± 0.02	0.38± 0.02	0.36± 0.02
Na ₂ O	2.61± 0.01	2.75± 0.02	2.77± 0.02	3.85± 0.02
FeO	5.65± 0.04	5.52± 0.04	5.63± 0.04	5.00± 0.04

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APPENDIX A
SAMPLE LOCATION AND DESCRIPTION

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N1	L	Lund, Utah	SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R. 14W. 5900 ft. contour interval. Light pink nonwelded tuff with abundant darker colored xenoliths and tan to pink pumice blocks.
82N2	L	Lund, Utah	SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R. 14W. 5950 ft. contour interval. Tan to grey tuff with lighter colored pumice blocks; bronze colored biotites and sedimentary xenoliths.
82N3	L	Lund, Utah	SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R. 14W. About 30 m. below previous station. Lightly welded tuff with pink matrix and light pink pumice blocks. Abundant volcanic xenoliths.
82N4	L	Lund, Utah	SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R. 14W. About 20 m. below previous station**. Moderately welded pink to brown tuff with small, lighter colored pumice blocks.

* L = Lund, M = Minersville, WP = Wallaces Peak, NR = Needle Range,
CC = Condor Canyon, K = Kingston, SS = Shingle Spring, SE = South Egan.

** Reference made to stratigraphic distance rather than areal distance.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N5	L	Lund, Utah	NE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20 m. below previous station. Brownish-red welded tuff with light pumice blocks and sparcle lithic fragments (darker colored).
82N6	L	Lund, Utah	NE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 15 m. below previous station. Brown to red tuff with tan colored pumice blocks.
82N7	L	Lund, Utah	NE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 15 m. below previous station. Brown to pink tuff with light pink pumice blocks. Variable compaction of pumice blocks. Moderate welding.
82N8	L	Lund, Utah	NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20m. below previous station. Brownish red welded tuff with tan pumice blocks.
82N9	L	Lund, Utah	NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20 m. below previous station. Brown to red welded tuff with abundant pumice blocks up to about 3 cm. in length.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N10	L	Lund, Utah	NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20 m. below previous station. Brown to red tuff with pink pumice blocks.
82N11	L	Lund, Utah	NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20 m. below previous station. Same description.
82N12	L	Lund, Utah	NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T. 32S., R 14W. About 20 m. below previous station. Same description.
82N13	M	Minersville, Utah	NE $\frac{1}{4}$ Sec. 8, T. 29S., R. 9W. Collected at base of prominent northeast trending ridge near Utah State Highway 21, and about 20 m. above base of section. Brown to maroon colored welded tuff with altered mafic minerals and white feldspars.
82N14	M	Minersville Utah	NE $\frac{1}{4}$ Sec. 8, T. 29S., R. 9W. About 40 m. above previous station. Same description.
82N15	M	Minersville Utah	NE $\frac{1}{4}$ Sec. 8, T. 29S., R. 9W. About 30 m. above previous station. Same descriptpion.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N16	WP	Frisco, Utah	E $\frac{1}{2}$ SE $\frac{1}{4}$ Sec. 11, T. 26S., R. 15W. About 10 m. below superjacent Lund Member sillar along prominent ridge. Tan colored welded tuff showing visible compaction of pumice blocks which are lighter in color.
82N17	WP	Frisco, Utah	E $\frac{1}{2}$ SE $\frac{1}{4}$ Sec. 11, T. 26S., R. 15W. Grey to brown welded tuff with tan pumice blocks collected about 15 m. below previous station.
82N18	WP	Frisco, Utah	E $\frac{1}{2}$ SE $\frac{1}{4}$ Sec. 11, T. 26S., R. 15W. About 20 m. below previous station. Same descriptiion.
82N19	WP	Frisco, Utah	NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 12, T. 26S., R. 15W. Densely welded grey to brown tuff with tan colored pumice blocks. About 20 m. below previous station.
82N20	WP	Frisco, Utah	NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 12, T. 26S., R. 15W. About 15 m. below previous station and approximately 10 m. above contact with Cotton Wood Wash Member. Grey densely welded tuff with abundant small pumice blocks (less than 1 cm.).

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N30	NR-I	Halfway Summit, Utah	SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 10, T. 26S., R. 18W. Base of Wah Wah Tuff section near type locality for Cotton Wood Wash Member. Vitrophyre with small phenocrysts than usual.
82N30-A	NR-I	Halfway	SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 10, T. 26S., R. 18W.
82N30-B		Summit, Utah	The three samples were collected in an attempt to obtain the "freshest" sample from this station. Samples are altered along closely spaced north trending fractures (less than 1 cm.) between fractures. Brownish red tuffs about 5 m. above vitrophyre.
82N30-C			
82N31	NR-I	Halfway Summit. Utah	SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 10, T. 26S., R. 18W. Sample collected about 400 m. south of gravel road along 6100 feet contour. See previous sample description; crystal size larger, however.
82N32	NR-I	Halfway Summit, Utah	N $\frac{1}{2}$ NE $\frac{1}{4}$ Sec. 10, T. 26S., 18W. Sample collected at intersection of prominent drainage and section boundary for numbers 3 and 10. Alteration along north trending dikes. Tan to pink tuff with lighter colored pumice.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N33	NR-II	Halfway Summit, Utah	SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 27, T. 25S., R 18W. Vitrophyre collected near 6300 feet contour at the top of the N 20 W trending drainage. Vitrophyre appears to be offset to the east, just north of this station. Smaller phenocrysts than usual.
82N34	NR-II	Halfway Summit, Utah	NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 27, T. 25S., R. 18W. Sample collected about 600 m. south of highway along 6320 feet contour. Maroon tuff showing propylitic alteration associated with small pumice blocks.
82N34-B	NR-II	Halfway Summit, Utah	SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 22, T. 25S., R. 18W. Same description as previous sample.
82N35	NR-II	Halfway Summit, Utah	NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 26, T. 25S., R. 18W. North of highway near top of hill. Brick red tuff with visibly altered pumice blocks.
82N36	NR-II	Halfway Summit, Utah	SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 26, T. 25S., R. 18W. Brick red tuff with altered mafic minerals. Collected south of highway. Top of Wah Wah Tuff section exposed.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N37	CC	Condor Canyon, Utah	SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 27, T. 1S., R. 68E. Sample collected less than 10 m. below top of section. Welded pink tuff with red pumice blocks.
82N38	CC	Condor Canyon, Utah	SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 27, T. 1S., R. 68E. About 20 m. below previous station. Brown to pink tuff with lighter colored pumice blocks and sparse sedimentary xenoliths.
82N39	CC	Condor Canyon, Utah	SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 27, T. 1S., R. 68E. About 20 m. below previous station. Densely welded grey to brown tuff.
82N41	SS-I	Shingle Pass, Utah	Sample collected in lower part of drainage (6660 feet contour) about 1.5 km. northeast of Shingle Spring along jeep trail. White to light gray nonwelded tuff.
82N42	SS-I	Shingle Pass, Utah	About 10 m. above previous station in drainage. Grey welded tuff.
82N43	SS-I	Shingle Pass, Utah	About 10 m. above previous station. Pinkish grey welded tuff.
82N44-A	SS-I	Shingle	About 10 m. above previous
82N44-B	SS-I	Pass, Utah	station. Pink moderately welded tuff with white pumice blocks.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N45	SS-I	Shingle Pass, Utah	Sample collected at the top of the Wah Wah Tuff section in drainage. Light pink nonwelded tuff with white pumice blocks.
82-1	SS-II	Shingle Pass, Utah	Southeastern quarter of the quadrangle about half way between Shingle Spring and Granite Spring where ridge intersects jeep trail. Grey to pink welded tuff collected about 15 m. above base of section.
82-2	SS-II	Shingle Pass, Utah	About 10 m. above previous station. Same description.
82-4	SS-II	Shingle Pass, Utah	About 10 m. above previous station. Very similar appearance.
82-5	SS-II	Shingle Pass, Utha	About 10 m. above previous station. Similar appearance.
82N46	SE	Silver King, Nevada	Sample collected about 1.6 km. south of Perry Spring in the northwestern part of the quadrangle. Light grey poorly welded tuff with white pumice blocks.
82N47	SE	Silver King, Nevada	Sample collected about 20 m. below previous station. Same description, with greater welding.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
82N48	SE	Silver King, Nevada	About 20 m. below previous station. Light grey welded tuff.
82N49	SE	Silver King, Nevada	About 20 m. below previous station. Same description.
82N50	SE	Silver King, Nevada	About 30 m. below previous station. Sample is more densely welded than previous sample. Brown to pink tuff with light pink pumice blocks.
82N51	SE	Silver King, Nevada	About 15 m. below previous sample. Grey to black basal vitrophyre above contact with Cotton Wood Wash Member.
76-9-11	K	Junction, Utah	Kingston Canyon, about two miles west of Phonolite Mountain, $38^{\circ} 12'$ lat., $112^{\circ} 07'$ long., at sharp bend in stream and road, cliffs north of highway. Sample collected about 3 m. below top of Wah Wah Tuff section. Pink welded tuff lighter colored pumice blocks.
76-9-12	K	Junction, Utah	Sample collected about 10 m. below previous station. Pink welded tuff.

<u>SAMPLE</u>	<u>SECTION</u>	<u>QUADRANGLE</u>	<u>SAMPLE LOCATION AND DESCRIPTION</u>
76-9-13	K	Junction, Utah	Sample collected about 10 m. below previous station near base of Wah Wah Tuff section at this locality. Base of Wah Wah near base of cliff. Same description as previous sample.